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BULLETIN OF THE

TAYLOR SOCIETY, New York

A SOCIETY TO PROMOTE THE SCIENCE AND THE
ART OF ADMINISTRATION AND OF MANAGEMENT

PART I

OF

PROCEEDINGS

OF THE

MEETING OF THE TAYLOR SOCIETY

HELD AT

NEW YORK

DEC. 5 and 6, 1919

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29 W. Thirty-Ninth St.
New York

FEBRUARY, 1920 VOL. V, No. 1

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TAYLOR SOCIETY

ENGINEERING SOCIETIES BUILDING
29 WEST THIRTY-NINTH ST., NEW YORK

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President .... HENRY S. DENNISON, Dennison Manufacturing Co., Framingham, Mass. (1920)
Vice-President........ RICHARD A. FEISS, Joseph & Feiss Co., Cleveland, O. (1921)
Vice-President........ BOYD FISHER, Finance Building, Philadelphia, Pa. (1920)
Managing Director..... HARLOW S. PERSON, Taylor Society, 29 W. 39th St., New York.
Treasurer............. EDWARD W. CLARK, 3D, E. W. Clark & Co., Philadelphia, Pa. (1920)

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JOHN J. EAGAN, Atlanta, Ga. (1920)
ROBERT W. BRUERE, New York. (1920)

OBJECTS OF THE SOCIETY

(Extract from the Constitution)

The objects of this Society are, through research, discussion, publication and other appropriate means:

1. To secure an understanding and intelligent direction of the principles governing organized effort for the accomplishment of industrial and other social purposes for the mutual benefit of

   A. The Community
   B. Labor
   C. The Manager
   D. The Employer

2. To secure the gradual elimination of unnecessary effort and of unduly burdensome toil in the accomplishment of the work of the world.

3. To promote the scientific study and teaching of the principles governing organized effort, and of the mechanisms of their adaptation and application under varying and changing conditions.

4. To promote general recognition of the fact that the evaluation and application of these principles and mechanisms are the mutual concern of the community, labor, the manager and the employer.

5. To inspire in labor, manager and employer a constant adherence to the highest ethical conception of their individual and collective social responsibility.

(Continued on inside back cover)

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TAYLOR SOCIETY
A SOCIETY TO PROMOTE THE SCIENCE AND THE ART OF ADMINISTRATION AND OF MANAGEMENT
ENGINEERING SOCIETIES BUILDING
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COMMENT

ONLY part of the proceedings of the annual meeting held in New York, December 5 and 6, 1919, appears in this issue of THE BULLETIN—an account of the business session and the papers and discussions of the Saturday forenoon session. The papers and discussions of the Saturday afternoon and evening sessions will appear in the next issue, which will come from the printers early in April. The following subjects may therefore be expected in the April issue: "A Mathematical Discussion of Labor Turnover Formulas," by Carl G. Barth; "Mutual Ratings," by Henry W. Shelton; "The Need of Better Management in Mining Operations," by Hugh Archbald; and "The President's Industrial Conference of October, 1919," by Henry S. Dennison and Ida M. Tarbell.

THE business session of the annual meeting was possibly the most interesting session of the meeting. Business meetings of the past have been characterized by small attendance and the conventional dry routine usual in such meetings. The business session of the December meeting, however, brought out a large representation of the membership of the Society and was full of "pep" from beginning to end. Several factors contributed to this outcome. The arrangement of the annual dinner in connection with the business meeting was one; the interesting, forward-looking reports of committees was another; the presence and remarks of distinguished guests was perhaps the chief contributory factor. Details of the meeting are presented on other pages of this issue and should be read by all members who were unable to be present.

IN one respect at least the December meeting was not as satisfactory as the October meeting. Too many papers were scheduled at each session, with the result that there was not sufficient time for discussion. For instance, the discussion of Mr. Hathaway's excellent paper on "Standards" was voluntarily suppressed, because of the consciousness of another paper to follow; and the discussion of Mr. Thompson's admirable paper on "The Foreman" was impossible, because when the presentation of the paper was concluded, the time allowed for the session had expired. Each of these papers deserved an entire session and adequate discussion. The Society apologizes to the contributors of such papers and to those guests who came to discuss papers and then found no opportunity to do so. At future meetings papers of the importance of those presented at the December meeting will each be given an entire session.

WHEREAS the October meeting emphasized the administrative problem of industrial relations, the December meeting emphasized managerial problems—the problem of standards, of the foreman, of rating performance, etc., and devoted but one session to a purely industrial relations discussion. In that respect the December meeting was a model for what three out of four meetings of the Society should be. It should be borne in mind that while a fine spirit of cooperation within the entire personnel of a plant is essential to good management, it is not a substitute for good operating conditions and methods. Whichever is the foundation, the other is the superstructure. The foundation without the superstructure may show tangible results, but it is a wasted, because an incomplete, investment; a superstructure without foundation is unthinkable, is literally building castles in the air. The two are essential. And because "industrial relations" is chiefly a spiritual and mental

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problem, and discussion of it inspirational in its nature, a great deal can be accomplished at one meeting which emphasizes that problem. On the other hand, the problem of operating conditions, while in part a problem of the spirit and of the mind, is also in large part a problem of details, of experiments and investigations and of the comparison of results. And opportunity for the presentation and comparison of the results must be adequate, if the Society is to contribute to industry the results of the experiments and investigations of its members and guests.

GREETINGS TO M. LE CHATELIER

IT was the privilege of the Society to recognize the pioneer work of M. Henri le Chatelier on behalf of scientific management in France and to extend to him its greetings, by motion of Morris L. Cooke, as follows:

"Mr. Chairman: While sitting here this evening I have recalled a conversation I had with Mr. Taylor sometime in the Fall of 1911. I had just returned from a trip abroad and was recounting to him some of the experiences I had had with our scientific management friends in Germany. And I remember distinctly that Mr. Taylor said to me that when it came to the development of scientific management in foreign countries, his ambition lay in the direction of having it begin first in France.

"Those of us who have had the rare privilege of talking with our guest, M. de Freminville, during his visit to this country, have been impressed by his description, more than is possible through the written or printed word, of the tremendous progress which has been made in the development of scientific management in France during the eight years which have intervened since that conversation with Mr. Taylor.

"To M. Henri le Chatelier, an honorary member of this Society, we owe unbounded admiration for the disinterested way in which he—at first practically alone, and led to it by scientific recognition of evident truth, and devotion to what he believed the best interests of his country—started in to awaken France to the importance of scientific management. It was because of his fidelity and standing as a scientist, because of the admiration which his compatriots have for him, that he drew to the cause such friends as M. de Freminville.

"That in those eight years a small group of men should have accomplished what they have accomplished is remarkable; and I imagine it will not be long before we are made aware of what a significant part the work of that group of men played in the outcome of the late war.

"It seems to me appropriate that tonight the Taylor Society should request M. de Freminville to convey its greetings to M. le Chatelier, and I move you, therefore, that our distinguished guest of this evening be requested to convey to M. le Chatelier our sincerest admiration and unbounded thanks, and assurances that, if at any time this Society or its affiliates can be of service to him or to his country in this work of the further development of scientific management, we are at his command."

The motion was carried unanimously by rising vote, and M. de Freminville arose and responded:

"It is with great pleasure that I shall deliver this message to M. le Chatelier, and you may be sure it will be a great pleasure for him to receive the message, and I know he will send you his best thanks as soon as I have carried the message to him."

THE SOCIETY

THE annual business meeting of the Society, Friday evening, December 5, 1919, was called to order by the Managing Director who in the course of his remarks said:

"This is in many respects a significant meeting of the Society. I believe it was in this building, in a smaller adjacent room, that some ten years ago a group of half a dozen men met together and organized the Society to Promote the Science of Management, which, after Mr. Taylor's death and in his memory, changed its name to the Taylor Society. It is interesting that, by coincidence and not intention, this first meeting of, so to speak, the refounded Society, should be held in a room adjacent to that in which was held the meeting at which some ten years ago the Society was founded.

"It is also interesting and significant that we have with us, for the first time in our history, distinguished foreign guests, and especially significant that two of them are representatives of labor from England and Sweden respectively. It was only a few years ago that the attitude of labor was not one of sympathy with inquiry into the nature and the spirit of scientific management; today we witness most sympathetic inquiry. I imagine we were all to blame, and that the changed attitude marks development in breadth of view and humanness on both sides. A little later I shall have something to say of and to our distinguished guests.

"I suppose that logically this annual meeting should begin with a report of your executive servant, the Managing Director. However, we are just at the point in the development of the renewed activities of the Society at which great achievements cannot be reported, except the achievement of having established the machinery for serious and effective work. By the machinery I mean, of course, an executive, a central office, and certain standing committees. Possibly a year from now there may be a real report from myself, but tonight the reports must be those of committees, and their reports will be in the nature of statements of plans and progress rather than of performance.

"The establishment of committees I consider the one important achievement of your officers, for from them will come not only constructive work but counsel. For the first time the Society has operating departments as well as an overhead.

"For the benefit of those who are new to the Society and have never before had the privilege of attending a business meeting—of being intimately at home with the members—I wish to say that the Society was established some ten years ago; that up to the war it remained a rather small, close-knit body of very active individuals, earnest in the promotion of scientific management, principles and technique, in which they believed as in a religion. The Society did not grow rapidly; it did not try or care to. It was much like a church; a group of people inspired by an idealism and not a commercial motive.

"During the war its activities were almost completely suspended. It was found inconvenient to even hold meetings, for all the officers and half the members were absorbed directly into the war machine, and an additional number were equally absorbed into war service because of the increased intensity of production in their plants.

"With the armistice people began to take stock of the results of the war. Because of the consciousness that new problems had come to industrial society, it was believed by the members that great opportunities were presented to this Society. Greater productive effort to repair waste; the re-establishment of harmonious industrial relations—these were the obvious problems; and here existed a Society in command of the technique essential to greater production and inspired by the desire to promote sound and harmonious industrial relations; above all, free of any taint of commercial motive and inspired by the desire for service as by a religion. It seemed to be the duty of this Society to make its influence more effective and to that end to interest in its work more persons who appreciate the nature of the industrial problem. So, as you all know, a new constitution was adopted last Spring, an executive office was established, a dignified campaign for increase of membership was undertaken, and effort to offer worth-while service was begun. I say "begun"; a year from now I hope to report achievements.

"I should like to say in concluding, that service on your behalf in the Society's office has been more than an inspiration; it has been a revelation. The interest in scientific management the world over is astounding. There has been a constant stream of inquiring persons coming to my office, just as in earlier days such a stream used to flow into Boxley. Inquirers want to know about good management; what it is; how it may be developed; where it may be seen; what ideals are essential to it. They have come not only from the many parts of the United States, but from England, France, Sweden, Norway, Switzerland and Czecho-Slovakia; and this great volume of personal calls has been supplemented by inquiring letters from these and other countries of Europe. We do not advertise; how they have learned about us I do not know; nevertheless they come. It is an inspiration to know that there is realization of the need of science in industrial effort, and that its use must be governed, not by the commercial motive merely, but primarily by the idealism of social service, such as is represented by this Society."

After the announcement of the election of officers the Chairman called on the new President, Mr. Henry S. Dennison, who responded:

"Mr. Chairman, Ladies and Gentlemen: This Society obviously needs no lessons in efficiency in taking advantage of absentees. I could never do justice to the strong-arm work of one Mr. Bruce, Chairman of the Nominating Committee. While I was in the Maine woods, recuperating from the President's industrial conference and out of touch with mail, I was nominated to be your President, and to my surprise, elected. You may not need lessons in efficiency in putting through your plans, but I wonder whether you may not need lessons in forming sound judgments.

"The honor is a source of great gratification to me. I do have a feeling of insecurity with respect to the proper performance of my duties; but I appreciate the honor. Seriously aroused to the opportunity, I might say, indeed, that I promise to give to the work every ounce of energy and every bit of time—at the disposal of the Managing Director.

"The place of this Society is just now one of very great importance, one of absolutely vital importance, to my way of thinking. I had the pleasure, without giving any sort of return for it, of being a member of the President's industrial conference in Washington in October, there getting contacts that are perfectly priceless, and points of view that I shall value all my life. Every reflection that came from those contacts pointed to the need of clear thinking and of what we call the scientific attitude in management.

"If I am anywhere near right in my conception of what scientific management is, of what that approach to business problems is, which Mr. Taylor first began, there should be absolutely no question in Miss Bonfield's mind of the position of the worker. Machines are the mechanical engineer's problem; materials and mechanical methods his problem. Our problem, that of the manager, is the human problem.

"If one considers the human problem as a mechanical problem, one hasn't begun to consider it. It is a problem of human nature. Can one lead men rightly when one leaves out of account the instincts that have been developed in them through thousands of years? Can one suppress desires and yearnings that are in the very nature of man, without acting obviously against one's own and society's interests?

"Scientific management of men is management which will give them the utmost of satisfaction; otherwise it is ridiculously unscientific.

"Now, capital is in no condition, mentally or otherwise, to solve the problem of scientific management. The manager-engineer must solve it; *you* must solve it. It cannot be that the problem will be solved by the lawyer at the head of a corporation, who has not the background of contact with the shop and with the worker. Those of us in industry have only too little of it!

"I recall saying at the Cambridge meeting that I believe the next significant step in scientific management, in the work which Mr. Taylor started, involves cooperation with the worker; organized cooperation. This is not sentimentalism; it is cold-blooded science. The beginning of organized cooperation with the worker marks the beginning of the passing of the industrial relations problem from the present hopelessly acute stage into the stage of the sort of problem which science is continually presenting to us; a problem never solved, but which is always being solved; always offering to mankind advantage and opportunity for further development.

"Today it is nothing but a fight, a hopeless destructive sort of fight. It is through this Society that I hope and believe that the transformation of that destructive method into a fine, constructive method will take place; and I am more than glad to take such small part in it as our Managing Director will allow."

DISTINGUISHED GUESTS SPEAK

IN his opening remarks at the annual business meeting the chairman said: "We have with us tonight, as guests, three distinguished representatives from Europe. It gives me pleasure to welcome them on your behalf. It is fortunate that the labors of the several missions of which they are members have been concluded and that they can on that account find the time to honor us with their presence. That they should choose to attend our meetings is especially significant when we realize the variety of competing interests—people and things they desire to see in the short period before they sail. It is especially significant that two of our guests are official representatives of labor in European countries: Miss Margaret Bonfield, of London, Assistant Secretary of the National Federation of Women Workers and Member of the Parliamentary Committee of the Trade Union Congress, technical adviser of the British delegation at the international labor congress recently held in Washington; also Miss Kerstein Hesselgren, of Stockholm, Factory Inspector for the Swedish government, and technical adviser of the Swedish delegation at the international labor congress. That they should wish to take back to labor in their respective countries first-hand information concerning scientific management and the Taylor Society is of importance to us. Monsieur de Freminville, of the French economic mission, comes not merely as a guest but as a member. To him I extend the greetings of fellow-members, and I also desire to extend to him the congratulations of the Society that he, and through him the Society, should have just been honored by his election as an honorary member of the American Society of Mechanical Engineers." Later in the evening the chairman introduced the guests with these words: "I am now going to vary the monotony of routine business by action that will be pleasurable to you. I am going to ask each of our guests for a few remarks, as a penalty for associating with live and inquisitive people."

MISS BONFIELD: I think this is taking a mean advantage. I was promised that if I came here tonight I was to be a listener and see what was performed.

However, your chairman has very kindly said that you expect only a few remarks.

May I say first of all with what great pleasure it was that I received the invitation to come here tonight? I have seen various aspects of American life and I was particularly anxious to see the aspect represented by your Society, to sense the atmosphere with which you men who are engaged in scientific management are trying to approach the problem.

I speak as a trade union officer seriously interested in this question of scientific management from an entirely critical point of view. We have in our country, Great Britain, watched some of the industrial experiments here in the States, and quite frankly we have felt that we have nothing to learn from them as far as the workers were concerned; we have felt that if anything they were likely to be dangerous if the British manufacturer attempted to introduce them into our country. But we have not stopped at that point. We have tried very earnestly to see to what extent trade unions could study scientific management with a view to lightening the burden falling upon the shoulders of the workers, and I was particularly interested in the report of the Research Committee on this question of unemployment. It is probably one of the most difficult —certainly from the worker's point of view it is one of the most vital—of all the problems with which we are faced.

That feeling of insecurity constantly haunts the life of the manual worker, of the casual worker, and even of many of the rank of the permanent workers. It is one of the great shadows helping to depress the whole existence of the working class, and I am deeply interested in the fact that you are going to make a scientific investigation of it. We are making proposals in our country for dealing with unemployment, and from the worker's point of view we are always emphasizing the note of prevention of unemployment. We think it is such an awful waste of human energy, such a waste of skill, such a waste of resources, such a waste of the standard of living in the home, that there should be these periods of unemployment; and we are confident that they need not exist, that it is perfectly possible to so organize industry, so organize the distribution of goods, that there should not be these periods of rush and these periods of slackness under any really scientifically managed method of production. So I am heartily glad to know that you are on the way toward this investigation.

The other thing that perhaps you will forgive me, if I emphasize it again, from the worker's point of view, is what appears to be sometimes the introduction of a still more mechanical attitude towards production. There are so many employers, you know, who are so keen about output that they seize upon the mechanical side of scientific production and entirely neglect the human side, which is the keynote of the attitude of this Society; and if there is one emphasis I should like to make more than another it is that in perfecting your mechanical science you will use the whole weight of your Society continuously, in season and out of season, to impress upon the captains of industry that industry after all should be the servant of humanity and not its master.

That is the side of life which we laborers are perhaps over-emphasizing, but which I do think the people on the other side of the fence sometimes entirely underestimate. To humanize industry, to make work not merely a less unpleasant thing but to make it really a joy, to make it a thing that every one will want to do, should be the aim of science, and I am perfectly confident it is not a Utopian dream at all. We have that aim inside our own cooperative movement, about which some of you may know; we have many setbacks and we would gladly have more science applied to the management of cooperative societies. We have proved that working in the service of a community can be a greater incentive than even making money. We have proved that we can hold and retain the services of managers of great capacities, managers who would be bought out if they were buyable by commercial concerns, but who prefer to remain salaried persons because they can help to evolve a system of business which endeavors to create a cooperative commonwealth; and I am sure as we move on in the program of the world and in the progress particularly of science as applied to industry for the purpose of making it the servant of humanity, we shall enter into new realms more inspiring, still more adventurous, and, yes, I venture to say, more romantic even than the tales of the knights of old.

I think to harness iron and steel, to harness the great waterways, to harness electricity, to take all the raw materials of the earth and place them at the disposal of humanity is one of the greatest adventures that anybody has ever been called upon to perform. And we who are working in the ranks of the trade unions, we have our minds set upon that and we want efficiency. We want scientific management, but we want also a real partnership in these things on behalf of the workers. We want and we claim and we demand educational opportunities, opportunities to develop the faculties, to develop those gifts with which nature and with which God has endowed the children of the poor as well as the children of the rich; and I am sure if we can all go ahead in that spirit of trying to harness the resources of the earth to the service of humanity we shall all feel a greater joy in life itself.

Miss Hesselgren: You may understand that for a person who speaks another language to come after Miss Bonfield is extremely embarrassing. She has put in the finest manner possible all the things I should like to emphasize. But perhaps I can say as much also of our country up in the very far North; more scientific management is coming, and it is looked upon with very much distrust in many ways, and being a factory inspectress, I have come across this question over and over again.

I see in the different factories how differently they are managed, how much the work is worse in some factories than in other factories in the same kind of trade. On the other hand, when I speak to the work people about taking up anything in this way of management, they are all suspicious; they always say, just as Miss Bonfield said, that they believe employers don't want to do anything with that except "make us more like machines than we are now, and we absolutely won't have it."

I have a feeling that that is, of course, not the right view of this thing, and I have been longing for many years to come over here and see it first hand. But when I finally came over to this country, I just jumped over. I didn't know until a week before I sailed that I was coming, and when I arrived I had to work hard from early in the morning until late in the evening in that Washington conference. So I didn't have any time at all to come in touch with scientific management until these last few days here in New York; and then, I thought, I must try to get in closer touch with it; and you may imagine my happiness when I yesterday afternoon came upon Miss Van Kleeck and heard from her about this dinner and this meeting here that would bring me in contact with the very essence of wisdom on this point.

I felt that would be a liberal education for me, and you must realize when one has to pack the education into this evening and perhaps a little tomorrow again—that you can't expect me to go back to my country with very much. But somebody has made me promise to become a member of this Association. I don't know whether you will allow a foreigner to become one and to keep in touch with you, and to try to understand more of scientific management, and to try in my own country to combat that feeling of mistrust among the trade union people.

I am absolutely sure that if we can get the trade union people to take hold of this question before scientific management enters into our country to any great extent, we will achieve what Miss Bonfield wants; and I think now is the moment when it ought to be introduced, because we are going to have the eight-hour day and all of these changes in methods of work, and I think their minds are open for making changes. And if we can get the trade unions themselves to take hold of the thing, I have great hope for it.

I must say that the little I have been able to learn during this evening here gives me great hope that that is possible, and I think I can go back to Sweden with the feeling that even if I haven't had the time to study scientific management as I wanted to, I have made contacts that will enable me later on to study it further. And I thank you very much for the opportunities of this evening.

The Chairman: While Miss Bonfield and Miss Hesselgren were speaking, I had a vision, and that was a vision of the beginning of the clearing away of the misunderstanding and misapprehension in regard to scientific management in England and in Sweden; and of the time when we can say that this little visit tonight was the beginning of it.

M. de Freminville: Ladies and Gentlemen: I was very little prepared to speak tonight. I was only enjoying the very great pleasure of renewing the contact with many friends here, and bringing back the keen reception I received from Mr. Taylor in past years.

You asked me to say a few words on scientific management. You have heard just now two ladies speaking in a very impressive manner about scientific management and labor. Of course, I am not at all qualified to speak in behalf of labor, but I must say that from the beginning if scientific management was imposed upon my mind as a very good thing, it was because I believed thoroughly that it could be applied in behalf of the working people.

You have heard these ladies express one of the fears of the workman as unemployment. I have kept my eyes upon that point all the time I have had workers with me. I knew very well that they were afraid of being unemployed, and I thought that my first duty was to conduct my business so as to avoid unemployment to the best of my ability. I have succeeded in that for many years, and I must say that the men I have had with me responded splendidly to my expectation.

It is difficult to avoid unemployment on a small scale; one must plan one's work a long time beforehand to be certain not to have unemployment. To do that it is certainly necessary to go into details, to know exactly how the work must be conducted, to have the best means of doing the work; and there you bring scientific management into contact with the workman. I don't think at all that by doing that you turn the workman into a machine. That is not my experience.

ANNUAL BUSINESS MEETING

THE annual business meeting of the Society was held at Keene's Chop House, Friday evening, December 5, 1919, following a dinner at which members and invited guests were present. In contrast to business meetings of other years the attendance was large (over one hundred were present) and the meeting interesting—fully as interesting (to guests as well as members) as sessions devoted to the discussion of papers. The conspicuous enthusiasm was due in part to the spirit of informality and good-fellowship inherited from the dinner, to the forward-looking reports of the committees, evidence that the Society at last "consists of operating departments as well as an overhead," and to the presence of distinguished European guests whose happy and sympathetic remarks, in response to the call of the chairman, broke the monotony of the consideration of purely business matters and increased in every member the feeling that the Society has before it opportunities to promote the better direction of productive efforts and more harmonious industrial relations—not merely in the United States but among other peoples. That two of the guests were official representatives of labor in England and Sweden, respectively, and another an official representative of French industry, is noteworthy.

The remarks of speakers which did not pertain specifically to the business affairs of the Society are printed elsewhere in this issue of THE BULLETIN.

Report of the Treasurer. The Treasurer's report, submitted in writing, will be printed separately and mailed to the members of the Society.

Report of the Finance Committee. Richard A. Feiss, Chairman:

The Committee had considered the problem of increasing the income of the Society to make possible extension of the work of the office of the Managing Director. That office had kept within its budget of $1,000 per month, but a fifty per cent increase in the budget was essential to carry on the work of the office during the ensuing year. It was necessary also to increase the income to absorb the underwriting obligations which had been necessary to establish a Managing Director's office for the Society. After consideration of this problem the Committee had come to the following decisions:

1. That the principal sources of income for the Society for the immediate future, would have to be initiation fees and dues of the various classes of membership, and that any increase in income must come primarily from increase in membership.

2. That the initiation fees and dues of Active, Associate and Junior Members be not changed.

3. That life memberships be encouraged and that the Constitution be changed to provide for a life membership upon the payment of $1,000 in four annual installments; the principal resulting from such payments to be held in a special reserve fund and returnable to life members then living if and when the Society may be dissolved; the income of such fund only to be used for operating expenses of the Society; Life Members to be relieved of the payment of initiation fees and annual dues. To that end it is proposed that Article C 12 of the Constitution, concerning life membership, be so amended that for the words "by the payment, at one time, of an amount sufficient to purchase from some legally incorporated life insurance or other company an annuity on the life of a person of the age of the applicant equal to the annual dues of his grade," there be subsitituted the words "by the payment of $1,000 in four annual installments."

4. That the number of Sustaining Members be increased and that the Constitution be amended to permit the payment of dues by Sustaining Members in accordance with ability to contribute; and that to that end it be proposed that Article C 11, concerning dues, shall be amended by substituting for the words "of a Sustaining Member, $100" the clause: "of a Sustaining Member, not less than $100 and not more than $500, to be determined by the Board of Directors and in accordance with the applicant's ability to contribute."

5. That there be organized and undertaken at once in cooperation with the Membership Committee, an intensive membership campaign of six months for the increase of eligible members of all grades; that the Managing Director be expected only to plan and supervise such campaign; that he have an assistant of suitable experience and personality for the necessary field work; that the necessary fund for such campaign

(estimated at $2,500) be secured by voluntary contributions of $100 each from twenty-five members; that the fund be used for the salary (6 mos.) of the assistant, his traveling expenses and printing, etc., incidental to the campaign. (The report was adopted.)

Report of the Membership Committee. Keppele Hall, Chairman:

The Committee wished to appeal to every member of the Society to make himself an informal member of the Committee, and secure his quota of new members. The success of the plans of the Finance Committee depended upon the work of the Membership Committee. There were then 216 members and 17 sustaining members, nearly double the number at the beginning of the year; but the Committee believed there could be found 500 or 600 persons, "genuinely interested in management as a science," who would be glad to avail themselves of the privilege of membership, if they were sought out by the members and the purposes of the Society made known to them. Every member should get busy and find three to five new members. The Membership Committee had laid out the country into regions and appointed a regional sub-committee in each, but that did not free each member from his individual responsibility. The importance of members of junior grade—the young men, the leaders of the future—should be kept in mind; effort should be made to interest in membership the young men coming out of engineering schools and schools of commerce and business administration. "Every member is expected to do his duty." (The report was adopted.)

Report of the Research Committee. Morris L. Cooke, Chairman:

The Research Committee was not a committee which itself conducted research; its function was to initiate, foster and coordinate research, decide what problems required research and establish committees to conduct the research decided upon. Only recently appointed, its work to date had been principally one of surveying the field. It had decided not to attempt any widespread work, but to begin one or two tasks and try to make a record with respect to them. It had appointed one sub-committee on Collegiate Instruction in Management, to study the formulation of principles of management, the content of a curriculum on management and methods of teaching. It had also decided, after much encouragement resulting from discussion with leaders of labor, to undertake a study of "unemployment within employment," to ascertain whether there could not be worked out some common measure of the unemployment of those supposed to be employed and on their jobs. There was a growing conviction among the members of the Society that the great unemployment problem is not so much concerned with people who haven't jobs as with keeping those with jobs continuously employed. A sub-committee had been appointed to outline definite plans for such a study. The committee asked for the cooperation of the members. In any such study 100 or 150 cooperating firms would be necessary; firms who would agree to keep the necessary records to furnish data for the study. (The report was adopted.)

Report of Sub-Committee on Collegiate Instruction in Management. Henry H. Farquhar, Chairman:

The Committee had interpreted its function to be that of surveying and comparing existing methods of instruction in management, of supervising experiments with respect to new methods and content of courses, and of working out and recommending a standard method and content. Having considered the problem, it had decided to begin work by the appointment of three special committees, the membership to be selected from the Society at large: first, a committee to formulate the principles of management to be taught; second, a committee on content of courses; and third, a committee on methods of instruction; these committees in these several fields under the supervision of the parent committee. The cooperation of every member is essential, for some of the most valuable data would come from those who use the product which comes out of the schools which teach management. (The report was adopted.)

Committee on Resolutions. The chairman called the attention of the Society to the recent death of Henry L. Gantt. It was voted that the President appoint a committee on resolutions, the membership of the committee and the resolutions to be published in an early issue of THE BULLETIN. (The resolutions have since been published in Vol. IV, No. 6, December, 1919.)

Election of Officers. The chairman then announced the results of letter balloting (during November) for officers for the ensuing year. The ballots had been opened and counted by a committee consisting of Henry W. Shelton, Henry H. Farquhar, and the Secretary to the Managing Director. The results were as follows:

For President, to serve for one year: Henry S. Dennison, 130; all others, 8.

For Vice-President, to serve for two years: Richard A. Feiss, 136; all others, 2.

For Vice-President, to serve for one year: Boyd Fisher, 130; all others, 7.

For Treasurer, to serve for one year: Edward W. Clark, 3rd, 135; all others, 3.

For Members Board of Directors, to serve for two years: Daniel M. Bates, 128; Frederic G. Coburn, 130; all others, 11.

For Members Board of Directors, to serve for one year: John G. Eagan, 128; Robert W. Bruére, 131; all others, 8.

Committee on Nominations. The chairman then called the attention of the members to Article C 23 of the Constitution, requiring that a nominating committee of five members shall be elected by ballot at each meeting, to nominate candidates for the next annual election. The nominations were received, a ballot was had, and the following members of the Nominating Committee were chosen: John M. Bruce, Henry P. Kendall, William H. Eaton, Mary Van Kleeck and Morris L. Cooke.

Amendments to the Constitution. The following amendments to the Constitution, proposed from the floor or as parts of committee reports, were adopted (preliminary adoption) as provided in Article C 29 of the Constitution:

1. That Article C 11, concerning dues, shall be amended by substituting for the words "of a Sustaining Member, $100" the clause: "of a Sustaining Member, not less than $100 and not more than $500, to be determined by the Board of Directors and in accordance with the applicant's ability to contribute."
2. That Article C 12, concerning life membership, be so amended that for the words "by the payment, at one time, of an amount sufficient to purchase from some legally incorporated life insurance or other company an annuity on the life of a person of the age of the applicant equal to the annual dues of his grade," there be substituted the words "by the payment of $1,000 in four annual installments."
3. That Article 22, concerning powers of the Board of Directors, be amended by the addition of the following: "and to establish such local and other subordinate sections as in its judgment will forward the purposes of the Society, and prescribe rules and regulations for their governance."

Message to Monsieur le Chatelier: On motion of Morris L. Cooke it was voted that M. de Freminville be requested to convey to "our distinguished honorary member," M. le Chatelier, the sincere admiration of the Society and its gratitude for the pioneer work of M. le Chatelier on behalf of scientific management in France. (The remarks in connection with this motion are printed elsewhere in this issue of THE BULLETIN.)

Frequency of Meetings. The Managing Director then asked for an expression of the opinion of the members regarding the frequency of meetings—whether four, three or two should be held each year. The opinion seemed to be equally divided between three and four meetings during the year. No vote was taken.

Thereupon the meeting was adjourned.

INDUSTRIAL PATENT MEDICINE

The medicine man who propitiates the angry spirits and invokes the blessings of beneficent deities is a feature of primitive culture. From the minds of twentieth century, civilized folk, he evokes only an amused smile. But the secret of his hold upon the imagination has not been lost. Despite the progress of science and the diffusion of scientific, cause-and-effect ideas, a large proportion of present day people still retain a primitive faith in the efficacy of his methods. They still believe in magic, in the ability to produce effects by vicarious causes.

The vogue of patent medicine, which has prevailed so widely in this country, is a capital illustration of this popular faith. Millions of persons have purchased remedies guaranteed to cure every ailment, incidentally providing large fortunes for the manufacturers of the nostrum, solely because of their credulity in continually advertised remedies and their hankering for short-cut cures. In this they are akin to the savage and his medicine man, whose aid he implores in exorcising the evil spirits which plague him.

This faith in magic or nostrums is but an expectation of future events where the believer is ignorant of the casual sequence and seeks to encompass the desired result with the minimum disturbance of his accustomed habits. The devotee of drugs hopes to rid himself of dyspepsia without altering his unwise habits of eating. The savage who is thwarted attempts to eliminate his enemy by burying his effigy, accompanied by incantations. Belief in magic flourishes in minds ignorant of cause and effect and eager for results with the least exertion or change in their habitual activities. Patent medicine appeals to the lazy and the obstinate.

It is not just to condemn the patent medicine devotee entirely. The maker of patent medicines must be held primarily responsible for preying upon his victims' ignorance. And so long as the physicians, who should know the nature of diseases and their cures, have themselves been ignorant of the causes, the poor benighted layman was entitled to some excuse for his dosing. The doctors' fumbling attentions in rheumatism and its allied ills have been enlightened by knowledge of systemic infections only within recent years.

In the industrial field, faith in the power of magic or well advertised cure-alls to cure the ills of the industrial body is undiminished. The manufacturer whose business is failing or whose employees are discontented turns with eagerness to the several specifics now flooding the market. If profits are dwindling, what better remedy can be had than a "system". It matters not that the manufacturer may himself be responsible for the failure, that his dogged adherence to tradition and convention is the cause of his difficulties; he is sure that if only he can get a "system" all will go well and no disturbance to his habitual activities will be necessary. Or, perhaps, he will invite criticism and a reorganization of his procedure, and then flatly refuse to adopt any changes which involve his personal activities. Business dyspepsia and continued unwise eating are common among our business folk.

It is in the field of industrial relations, however, that we find the best illustrations of the patent medicine habit of mind. The business men, who are now beset by labor troubles and can not imagine what has got into the minds of the workers, are turning to patent medicines to cure these ills. If the workers are complaining, give them a dose of industrial democracy, guaranteed to cure all industrial ills. In the minds of the business men, industrial democracy is anything which will quiet the workers without jeopardizing the control of the business. Thus, we have fifty-seven varieties of employees' representation and shop committees being installed in American industries, each of which, it is fondly hoped, will endear the management to the employees. The appeal of these schemes lies in the ease with which they can be adapted without affecting the existing organization and operation of the plant.

Along with these representative plans are found the personnel department. Again we have the patent medicine habit of mind, believing that by appointing a personnel director or employment manager the employees can be quieted without changing the vicious character of supervision and administration which is the cause of the employees' discontent. Profit-sharing, as a cure-all for industrial ills, has been advocated by some of our leading citizens and many industrial physicians, as though the remedy for a fever were to raise the patient's temperature! One is reminded of the Chinese doctor who treats eye troubles by punching a hole through the cornea.

The control of industry by business men, to whom the profit-making ideal is paramount, has subordinated the service or production ideal, with what results all can see. In their minds, the control of an industry means financial control for profit-making. This necessarily is incompatible with labor control, partial or complete, over any essential elements of the business, since labor seeks a larger income, continuous employment, and continuous production, all of which conflict with price maintenance and profit-making through restricted output. Hence, it is not difficult to understand the desire for a patent medicine which will eliminate these unruly labor aspirations and yet permit the present method of control to continue unchanged.

Here again the business men are not wholly to blame, for there are any number of industrial physicians who are ignorant of the systemic infection in industry and a growing number of industrial patent medicine vendors to cater to this demand. The newspapers, magazines, trade papers, and even some of the journals of a professional character carry their advertisements of industrial nostrums. "Install our system of shop committees," they say in effect, "and sleep soundly once more." "Take large doses of our industrial relations and see how your labor troubles vanish. Testimonials sent upon request." Or, frequently, they print letters from "satisfied" users commending their specific.

The aspirants for positions of employment managers or personnel directors are the most amusing of these versatile peddlers of panaceas. In a usually rather careful journal, devoted to management and engineering, there recently appeared the following personal cards:

> WANTED: POSITION AS EMPLOYMENT MANAGER AND SUPERVISOR OF LABOR, with an organization that desires exceptional ability and employs from an eight to a fifty-thousand force. I have a clever employment system and an after-the-war plan which develops mutual interest for the employer and employee. Will submit unusual results and recommendation from my present employer, besides other reference to any concern interested.

> EMPLOYMENT MANAGER. An executive, of high moral standing capable of organizing and installing an employment department, that will bring into industry justice and opportunity, be a mediator between labor and capital, a safety valve for dissatisfaction, a clearing house for discontent and a shock absorber for trouble, is open to offers from a progressive company. During the war we maintained a steady working force in one of the larg-

> est powder plants in the country and decreased the Labor Turnover by 250 per cent. I am 35 years old, full of enthusiasm, have full knowledge of all the most recent methods of handling help, and have been exceptionally successful in this work.
>
> EMPLOYMENT MANAGER: A college graduate, who has specialized in sociology, psychology, economics, and preventive hygiene, also has taken courses abroad in sociology, with eight years human engineering experience, combined with a knowledge of character analysis, psycho-analysis, placement psychology, safety, sanitary engineering, general welfare and industrial democracy, desires a position.

Yet, despite these personally extravagant claims, are they more misleading than many of the display advertisements and pamphlets issued by some of the established organizations? In their statements occur such phrases as: "Because employers have neglected the thoughts of workers, is the reason for the present-day unrest." "Appoint a day for our representative to call on you; the knowledge we will be able to impart will prove most refreshing." While "shop committee" and "industrial democracy" are sprinkled throughout, as "herbs" and "roots" figure in the advertisements of pain-killers.

There is no Pure Food and Drug Act to govern these men nor is there any law to prevent the business men from taking their nostrums. The real pity of it all is that sincere efforts to improve industrial relations by serious students of the problem are sure to be compromised by the inevitable failures of these ready-to-take remedies and the resulting skepticism of the employers.

Industrial democracy, if it means anything, must imply an aspiration, as does political democracy, and who is there to prescribe the system or scheme for achieving either aspiration? Viewed historically, it appears to be a desire, a longing for some new and better relationship in industry than the old master-servant relation. Considered as a social movement, the aspiration toward industrial democracy appears as only one more manifestation of the constantly recurring phenomenon, when the desires of the people no longer can find satisfaction in existing institutions and they turn with a feeling of profound frustration to new forms, new ideals, more consonant with the developing life of society and more effective for its aims. In that process the employment manager or personnel director can be but a temporary intermediary, one who can perhaps lessen the rigor of the conflict between employer and employees and keep the organization going, while management acquires the new technique of supervision and leadership and labor learns the art politic as a substitute for the art coercive.

The appeal of these soi-disant pacifiers of labor is to our profound ignorance in the matter of human behavior. We do not know, as yet, why people act as they do, although the work of the psychologists today is pointing toward a new orientation in this field. For so long we have believed in the power of wages to stimulate effort that the patent fact of money's impotence has escaped attention. Should the efforts of psychology result in a workable theory of human behavior, as they now promise, all of these widely advertised remedies and "professional" methods will be relegated to the scrap heap. Sound industrial relations are to be sought through the work of the technicians and of the psychologists and when the answer is found it will probably astonish by its simplicity. As Lord Dunsony remarks, "men are very clever, but the gods are wonderfully simple."

L. K. FRANK[1]

MEMBERSHIP STATISTICS

Members of the Taylor Society will be interested in the growth of the Society since the reorganization early in 1919:

	Jan. 1, 1919	Jan. 1, 1920	Apr. 1, 1920
Seniors	45	114	168
Associates	69	77	91
Juniors	12	35	47
Honorary	1	1	1
Total	127	227	307
Sustaining	9	16	24
Total	136	243	331

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[1] New York Telephone Co., New York.

STANDARDS[1]

BY

H. K. HATHAWAY[2]

I INTRODUCTORY

IN his book "Scientific Management and Labor," based upon an investigation conducted in 1915 for the United States Commission on Industrial Relations by a committee of which he was Chairman, the late Professor Robert Franklin Hoxie sets forth under the heading "Possible Benefits of Scientific Management to Labor and Society" a remarkable statement of the importance and necessity for the establishment and maintenance of standards. No more fitting introduction to this paper could be written; hence I wish to quote it in part:

> Experience and reason leave no doubt that a close causal relation exists between productive efficiency and possible wages. No one can deny, therefore, that greater productive efficiency and output make possible higher wages, in general, and better conditions of employment and labor. While in particular instances and trades, wage advances, improved conditions of work and better standards of living can be secured and maintained solely through increased bargaining power of the labor group, the community as a whole, including all classes of labor, can consume more and live better only through an increase in the goods produced. But increase of output is dependent on lower cost of production. Mr. Taylor was right, therefore, when he set up as a goal of achievement and principle of scientific management, "higher wages with lower labor cost." Lower labor costs make higher wages possible, and, while lower capital costs are equally significant in this respect, without both higher wages for all and in the long run are not likely to be realized to any considerable extent.
>
> In so far, then, as scientific management affords opportunities for lower costs and increased production without adding to the burden of the workers in exhausting effort, long hours or inferior working conditions, it creates the possibility of very real and substantial benefits to labor and to society.
>
> No one who has made a careful study of scientific management can doubt that it does, at its best, afford such opportunities to a very high degree. Fully and properly applied, scientific management may include and may not be incompatible with all that is covered in the phase "Science in Management," and it has of itself developed many devices for the saving of waste and many policies and methods for the improvement of the productive processes, not excluding ideas and methods which promise well for the betterment of labor conditions and the protection of labor interests.
>
> At its best, as set forth by Mr. Taylor, and as realized in practice, scientific management means a thoroughgoing improvement and standardization of the material equipment and productive organization of the plant before an attempt is made to apply its peculiar methods and devices to the determination of standards of labor efficiency and wage payments. It means, thus, the installation of the best available machinery and tools so far as compatible with economy, or, at least, the overhauling and improvement of the existing equipment; the careful study of the materials of production and the determination of the speed and feed of the machines calculated under the circumstances to be most effective; the rearrangement of the material equipment so as to avoid the delays and expense of unnecessary carriage of materials and partly finished product, and to secure so far as possible continuous straight-line production; the introduction of known and new devices for economical and expeditious handling of materials and product; the careful study and analysis of the detailed processes and methods of production looking to the elimination of waste motions; the improvement of accessories; and the most effective application of force and coordination of effort; the reorganization of the managerial staff with a view to avoiding so far as possible multiplicity of duties and to securing definiteness of function and responsibility, and therefore, managerial efficiency in every detail; the improvement of the methods of record keeping and accounting so that exact knowledge may be had at all times of available equipment and materials on hand, their disposition, actual and prospective, that the productive needs of the concern may be met without friction or delay; reorganization of the sales and purchasing departments with a view to broadening and stabilizing the market for the product, and purchase by specification, at the most economical rates, and in accordance with needs; improvements in the methods of stores-keeping which insure sufficiency of stock on hand, quick delivery and avoidance of interest and loss on superfluous and unusable stock; better methods of tool storage, care and delivery, and many other material and organic improvements, all possible, theoretically, precedent to and quite apart from the setting of new tasks; the introduction of new modes of payment or the alteration in general of labor conditions and relationships. . . . . .
>
> Scientific management not only holds out, therefore, possibilities of substantial benefits to labor, but it points the way and the only way toward raising the standard of living for all classes of labor and for society at large.

The *Century Dictionary* defines a "standard" as, "that which is set up as a unit of reference; a form, type, example, instance or combination of conditions accepted as correct and perfect and hence as a basis of comparison; a criterion established by custom, public opinion or general consent; a model."

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[1] A paper presented at the annual meeting of the Taylor Society, New York, Dec. 6, 1919.

[2] Consulting Engineer in Management, Philadelphia, Pa.

The writer wishes to disclaim any personal credit for the advantageous results cited as illustrations of standardization, in those cases where the work was done under his direction. While much credit is due to the men who conducted the investigations and worked out the problems, credit is almost equally due to the operators whose work was studied and who assisted in making the studies, as well as to the principal people in the management of the concerns in which the work was done.

It is mainly however to Taylor and his teachings that credit should be given, as the results were the inevitable outcome of the application of scientific methods to everyday industrial problems, and of the desire to work out in practice what Mr. Taylor stated as the first principle of scientific management,—"the development by management of a science in place of rule-of-thumb or traditional knowledge and method."

In addition to those individuals mentioned in the text of the paper the writer wishes to accord due recognition to Col. W. H. Eaton, Maj. M. C. Herrmann, Mr. Charles Hoffman, Mr. Arthur Holmes, Dr. Ralph Langley, Mr. Wilfred Lewis, Mr. L. S. Tyler and Capt. D. J. Walsh, for the part they took in bringing about the results cited, and to a host of others who took part in the work.

The above definition, almost but not quite, gives the significance of the word "standard" as it is used in connection with scientific management. If we change it to read: *"That which is set up as a form, type, example, or combination of conditions accepted as correct; a criterion, established as a result of scientific investigation,"* we should have a better definition of the term in the limited sense in which it is used in this paper. Inasmuch as it is the destiny of mankind to constantly advance and improve I would add, parenthetically, *"for the time being,"* or *"representing the present stage in the development of the art."*

We may classify the standards of scientific management under the following headings:

Equipment: including machines, tools or implements, facilities for handling, transporting or storing materials.
Materials
Methods
Accomplishment
Product

Standards of accomplishment are dependent upon standards of equipment, materials, methods and product.

In 1895 Mr. Taylor said in closing the discussion of his paper on "A Piece Rate System," in which he first described elementary time study as well as his differential piece rate system of pay: "I am surprised and disappointed that elementary rate fixing (scientific analysis and time study of work) has not received more attention during the discussion. No better evidence could have been produced, however, of the crude and elementary state in which the art now stands, of determining the *time to do work* and of fixing rates, than that only one member should have most briefly referred to the matter while thirteen engineers have discussed at length the less important matter of *what kind of piece work to use."*

The blame for that of which Taylor complained lay largely at his own door; he committed a serious error in the selection of the title for his paper; perhaps had he called it "The Establishment of Standards as a Means to Increased Production" or "The Study of Elementary Time Units for Doing Work under Standardized Conditions"; had he confined this paper principally to what was an epoch making advance in the art of industrial management, if not indeed the elevation of management from "rule of thumb" to an art, a scientific method of determining what represents a fair day's work or the time that a given job under given conditions ought to take; had he reserved the description of his novel pay system—the differential piece rate—for a later presentation, it is altogether probable that his message would have been better understood and more generally appreciated at its true worth.

This error of Taylor's, if it may be so characterized, is significant and shows that even he was not immune from the influences of the time. As is evident to anyone who studies Taylor's writing and is well known to those who were associated with him, the Taylor System, or scientific management, had its genesis in an endeavor to establish *"standards of accomplishment—or in other words to set piece rates on a just and accurate basis."* This Taylor found necessitated an analytical study of the work to be done, which at once brought to light the fact that *there can be no standard or uniformity of accomplishment without standardization of all of the conditions under which the work is done.*

Let us take for example the boring and turning of steel tires for locomotive wheels, which I think was one of the first, if not the first operation, to be studied at Midvale. Having as a result of experiment arrived at and established as standard, proper combinations of feed, cutting speed and depth of cut, it soon became apparent to Taylor that unless the cutting tools used by the machinists were practically identical in quality and temper of the steel and ground to practically the same shape, clearance and lip angles, these standards could not be attained. In this we have the beginning of the long series of experiments and research, described in Mr. Taylor's book "On the Art of Cutting Metals," which culminated in the invention of high-speed steel and Taylor-White process for its treatment; the slide rules started by Mr. Taylor and Mr. Gantt and perfected by Mr. Barth, and the Taylor standard lathe and planer tools. He found that the time-honored practice of each workman grinding his own tools must be abandoned; and the development of an automatic tool grinding machine followed, insuring uniformity and eliminating the loss of production and a variable element in the time taken to do the job as a result of the time spent by the workman at the grindstone or waiting his turn to use it.

Likewise it became evident that not only tools required for cutting, but those required for setting and holding work in the machines and the tools for measuring, must be standardized and must be of the same kind and in the same good condition *as those used when making the elementary studies* upon which was based the method and time prescribed—the standard of accomplishment. It was found also that they must *also* be on hand *when wanted* in order that the workman might not lose time procuring them or be forced to make shift with less suitable or inferior tools. Result: a tool room from which standard tools were provided.

In 1893 Mr. Taylor in his paper entitled "Notes on Belting" made a contribution to the engineering profession of which Mr. Henry T. Towne said in discussing it: "The present paper is modestly entitled 'Notes on Belting,' but could be more fittingly described as a treatise on the practical use of belts. Its thirty-four pages contain more new and useful information than is to be found in any other paper that has come to my knowledge." Here we have a notable example of the establishment and maintenance of standards which determined, for a given set of conditions, the speed, the thickness and width and the tension of leather belts for the transmission of power, and further, the development of a system for their upkeep.

Why Taylor went into it he clearly states as follows: "While working as foreman of a machine shop, the tools of which were frequently driven to their maximum capacity, the writer became convinced that the belts, which were laced according to the ordinary rules, were a great source of loss to the company—*not so much from the cost of the belting and the labor of lacing as from the incidental delays to the machines* and the diminished output of the shop resulting therefrom. This was *particularly emphasized when piece work rates were established* requiring the machines to be driven hard and continuously. The belting was then shown to be by far the largest source of trouble in the shop."

It was also found in this early effort to set just piece rates that in order to reach the standard of accomplishment greater attention must be given to having the material to be worked uniform in quality, that a scheme must be provided to insure the worker always having his next job ready, and that the condition of the machines must be kept up to an established standard.

All of this Taylor covers in his paper "A Piece Rate System" by the brief statement:

> Not the least of the benefits of elementary rate-fixing are the indirect results.
>
> The careful study of the capabilities of the machines, the analysis of the speeds at which they must run, before differential rates can be fixed which will insure their maximum output, almost invariably result in *first indicating* and *then correcting defects in their design,* and in the method of running and caring for them.
>
> But what is more important still, the rate fixing department has shown the necessity of carefully systematizing all the small details in the running of the shop: such as the care of belting, the proper care for cutting tools, and the dressing, grinding and issuing same, oiling machines, issuing orders for work, obtaining accurate labor and material returns, and a host of other minor methods and processes. These details which are usually regarded as of comparatively small importance and many of which are left to the individual judgment of the foreman and workmen are shown by the rate fixing department to be of paramount importance in obtaining the maximum output, and to require the most careful and systematic study and attention in order to insure uniformity and a fair and equal chance for each workman.
>
> While he (the writer) regards the possibilities of these methods as great, he is of the opinion that this system of management will be adopted by but few establishments, in the near future, at least; since its really successful application *not only involves a thorough organization, but requires the machinery and tools* throughout the place *to be kept in such good repair that it will be possible for the workmen* each day to produce their maximum output. But few manufacturers will care to go to this trouble until they are forced to.

If Taylor failed to bring out more adequately in the first published description of elementary time study the importance and absolute necessity for standards, it is not strange that the engineers and managers of that day should have missed the point, but it is astonishing that such a lack of appreciation and understanding should exist today!

Notwithstanding all that has been said and written, relatively few people seem fully to grasp the significance and the importance which reason and experience show should be attached to the subject. Even in shops in which the Taylor System has been applied the management comes to a complete understanding but slowly, as one by one things go wrong owing to imperfectly established standards or more frequently laxity or inadequate methods for their maintenance.

Within the past six months I have been consulted by several managers who sought through the establishment of some sort of a pay system a cure for their industrial ills, but who shied off when I explained to them what a real remedy involved. Quite recently in a very large plant I had the pleasure of attending a meeting of the "rate setters" from every department. In this plant they had slowly progressed through the stages of setting rates for piece work, premium work and contract jobs, based upon old records, the judgment or opinion of foremen or plain guess, to those based upon some sort of analysis or study, and in a limited degree had arrived at setting rates based on elementary time study. Just where Taylor was between 1885 and 1890! It was interesting to hear these men describe the difficulties they were contending with and trying to overcome; all due to lack of standards. The same old story of trouble with belts, tools, machines, materials, inadequate planning and lack of control. If left to themselves these men would perhaps ultimately and in somewhat less time reach the same point to which the Taylor System has developed today; but what a waste of time and energy, going over the same ground that Taylor went over, when they might profit by his experience!

A successful installation of scientific management calls for the establishment of standards; its continued successful operation calls for their maintenance.

There is, of course, nothing permanent about standards; they must be modified, discarded and replaced to keep pace with progress and change; but the fact that under a system of scientific management changes may not be made without full knowledge of all that they entail is a fine safeguard against their being instigated unwisely. Taylor frequently called attention to the folly and danger of making what he picturesquely but forcefully designated as "damned improvements." In this category he placed those changes or innovations which impulsive people are wont to make without due investigation and consideration, or in some cases simply to satisfy a desire for something new, and as a result of which many businesses are kept in a constant turmoil. The installation of scientific management is, as only those of you who have gone through it can fully realize, of necessity a long and arduous undertaking, calling not only for knowledge and experience but for infinite patience and confidence. Owing to the multiplicity of factors upon which success in the undertaking depends, not the least of which is the human factor, each feature of the system as installed may be expected to break down several times before it finally works smoothly. At such times there is a strong impulse to assume that the trouble may be corrected by making changes in the plan. The engineer directing the installation must be on his guard against changes, which in themselves may be harmless so far as the feature of the system directly affected is concerned, but which may fail to fit in with other features whose development may not be taken up until some later time. Each change of this character encourages others and may result in the complete failure of the undertaking, or what is almost as bad, in a mongrel system affording little satisfaction to anyone and which sooner or later may bring discredit to the scientific management movement. In this matter to follow the path of least resistance is almost always to court trouble.

After the system has been properly installed it is not so easy to make "damned improvements" or to lightly depart from standards, yet that must be guarded against, particularly by those high in authority who unfortunately cannot be expected to have a knowledge of all the details of the system, their relationship and interdependence. The motive for making such changes usually lies in a desire to correct a trouble resulting from some standard having been imperfectly established or maintained.

Most of the injustice with which ordinary piece work has been charged may be traced to lack of standards. We must be on our guard against further injustice. There are today managers who are unwilling to go to the expense or to undertake the work that is involved in the establishment and maintenance of standards essential to a true application of the principles of scientific management; they crave the benefits of increased production and delude themselves that they can get them by taking a short cut. These misguided individuals mistake the form for the substance just as did those who in 1896 discussed Taylor's piece work paper, and think that by merely making time studies—"frequently unworthy of the name"—and setting tasks they will get to the ultimate object directly. Alas, it won't work!

Several years ago a large establishment in Europe started, under the direction of an able engineer, to install the Taylor System. In one department it was well done, conditions were properly standardized and maintained, the work was routed and well controlled, proper tools and instructions were provided, and tasks were set justly on a basis of good elementary time study. Everything was going well in this department; so well in fact that the owner became impatient to see similar results in all other departments. He demanded that the workmen in another department be put on task and bonus, a certain number per day, faster than standard conditions could be established. The engineer in charge protested and left when the owner insisted. Nevertheless, the owner's orders were obeyed and a long and bitter strike resulted. In reality the men struck not against the system but for it. They said; "We can't make these rates; in the other department where you installed this system you have fixed up the machines and the belts and have men to keep them in repair; you deliver the tools—which are better than ours—to the machine in advance for each job; you have the material placed conveniently to the machine so that no time is lost between jobs. In that department the time can be made and the men earn their bonus. We have to take care of our own machines and belts, hunt up and grind our own tools and hunt up our own jobs. We demand that you do in our department what you did in the other department."

The late James M. Dodge told a story to the effect that shortly after the Taylor System had been installed in the shops of the Link-Belt Co., a friend of his—the head of a large machine works—after seeing and having explained to him the slide rules by which the proper combination of feed, speed and depth of cut are computed, persuaded Mr. Dodge to lend him one for a day or two in order that he might show it to his superintendent and foreman. A short time later Mr. Dodge heard that this friend had stated at a meeting of some kind that "he had tried the Taylor System in his shop but that it had proved a failure." Upon investigation it was found that he had taken the slide rule—specially designed for a machine in which the speeds and feeds had been standardized, as had also been the cone and countershaft belts, and in which were used standard cutting tools—and had tried to operate according to it a machine in his shop for which none of the conditions had been standardized!

It is indeed surprising that the importance of standards in the attainment of results should be so little understood or appreciated. Only ignorance, the adherence to policies of "penny wisdom and pound foolishness," reluctance to assume responsibility, or sheer indifference on the part of the management can account for it.

In the paper "Shop Management" Mr. Taylor made the following statements with reference to standards:

> "In many cases the greatest good resulting from the application of these systems is the indirect gain which comes from the enforced standardization of all details and conditions, large and small, surrounding the work. All of the ordinary systems can be and are almost always applied without adopting and maintaining thorough shop standards. But the task idea can not be carried out without them.
>
> The adoption and maintenance of standard tools, fixtures and appliances down to the smallest item throughout the works and office, as well as the adoption of standard methods of doing all operations which are repeated, is a matter of importance, so that under similar conditions the same appliances and methods shall be used throughout the plant. This is an absolutely necessary preliminary to success in assigning daily tasks which are fair and which can be carried out with certainty.
>
> One of the most important functions of the planning room is that of the maintenance of the entire system, and of standard methods and appliances throughout the establishment, including the planning room itself.
>
> By the adoption of standards and the use of instruction cards for overhauling machinery, etc., and the use of a tickler, the writer reduced the repair force of the Midvale Steel Works to one-third its size while he was in the position of master mechanic. (There was no planning department, however, in the works at the time.)
>
> It would seem almost unnecessary to dwell upon the desirability of standardizing, not only all of the tools, appliances and implements throughout the works and office, but also the methods to be used in the multitude of small operations which are repeated day after day. There are many good managers of the old school, however, who feel that this standardization is not only unnecessary but that it is undesirable, their principal reason being that it is better to allow each workman to develop his individuality by choosing the particular implements and methods which suit him best. And there is considerable weight in this contention when the scheme of management is to allow each workman to do the work as he pleases and hold him responsible for results. Unfortunately, in ninety-nine out of a hundred such cases only the first part of this plan is carried out. The workman chooses his own methods and implements but is not held in any strict sense accountable unless the quality of the work is so poor or the quantity turned out is so small as to almost amount to a scandal. In the type of management advocated by the writer, this complete standardization of all details and methods is not only desirable but absolutely indispensable as a preliminary to specifying the time in which each operation shall be done, and then insisting that it shall be done within the time allowed.
>
> Neglecting to take the time and trouble to thoroughly standardize all of such methods and details is one of the chief causes for setbacks and failure in introducing this system. Much better results can be attained, even if poor standards be adopted, than can be reached if some of a given class of implements are the best of their kind while others are poor. It is uniformity that is required. Better have them uniformly second class than mainly first with some second and some third class thrown in at random. In the latter case the workmen will almost always adopt the pace which conforms to the third class instead of the first or second. In fact, however, it is not a matter involving any great expense or time to select in each case standard implements which shall be nearly the best or the best of their kinds. The writer has never failed to make enormous gains in the economy of running by the adoption of standards.
>
> It was in the course of making a series of experiments with various air hardening tool steels with a view to adopting a standard for the Bethlehem works that Mr. White, together with the writer, discovered the Taylor-White process of treating tool steel, which marks a distinct improvement in the art; and the fact that this improvement was made not by manufacturers of tool steel but in the course of the adoption of standards, shows both the necessity and fruitfulness of methodical and careful investigation in the choice of much neglected details. The economy to be gained through the adoption of uniform standards is hardly realized at all by the managers of this country. No better illustration of this fact is needed than that of the present condition of the cutting tools used throughout the machine shops of the United States. Hardly a shop can be found in which tools made from a dozen different qualities of steel are not used side by side, in many cases with little or no means of telling one make from another; and in addition, the shape of the cutting edge of the tool is in most cases left to the fancy of each individual workman. When one realizes that the cutting speed of the best treated air hardening steel is for a given depth of cut, feed and quality of metal being cut, say sixty feet per minute, while with the same shaped tool made from the best carbon tool steel and with the same conditions, the cutting speed will be only twelve feet per minute, it becomes apparent how little the necessity for rigid standards is appreciated.
>
> Let us take another illustration. The machines of the country are still driven by belting. The motor drive, while it is coming, is still in the future. There is not one establishment in one hundred that does not leave the care and tightening of the belts to the judgment of the individual who runs the machine, although it is well known to all who have given any study to the subject that the most skilled machinist cannot properly tighten a belt without the use of belt clamps fitted with spring balances to properly register the tension. And the writer showed in a paper presented to this Society in 1893, giving the results of an experiment tried on all of the belts in a machine shop and extending through nine years, in which every detail of the care and tightening and tension of each belt was recorded, that belts properly cared for according to a standard method by a trained laborer would average twice the pulling power and only a fraction of the interruptions to manufacture of those tightened according to the usual methods. The loss now going on throughout the coun-

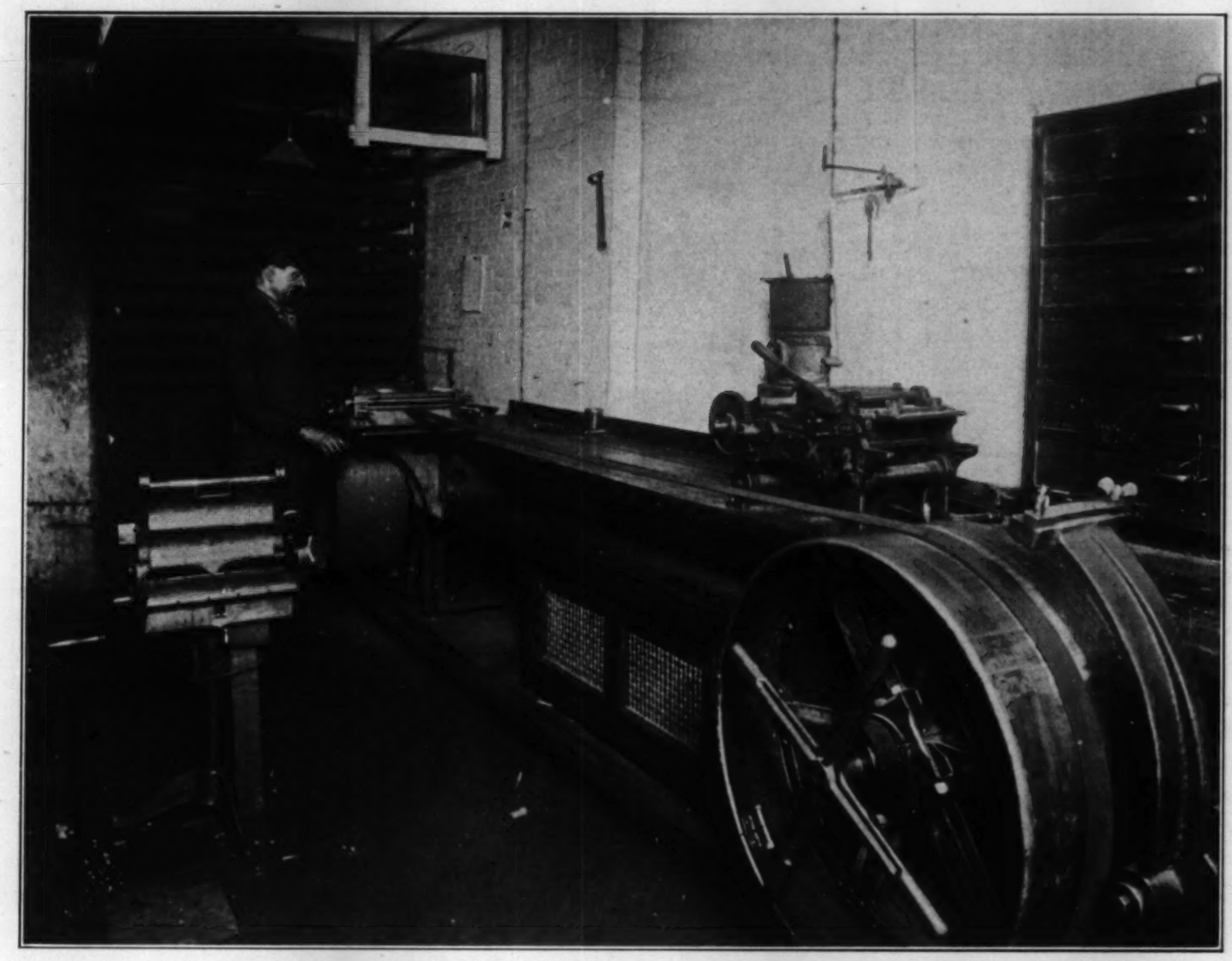


FIG. 1. Barth-Gulowsen "Belt Bench." A device for periodically inspecting, repairing and tightening belts. An outgrowth of Taylor's work in standardizing belting practice.

> try from failure to adopt and maintain standards for all small details is simply enormous.
>
> It is, however, a good sign for the future that a firm such as Messrs. Dodge & Day of Philadelphia, who are making a specialty of standardizing machine shop details, find their time fully occupied.

Does not Taylor seem to have set forth the nature and importance of standards clearly and forcefully enough in this paper to have made an impression on his audience? Again if one may judge from the character of the discussion, they did not get his message. Fourteen members discussed the paper on the occasion of its presentation. The discussion covered industrial relations with special reference to what the speakers conceived to be the principal iniquities of trades unions as of that date; political economy; the natural resources of the United States; the relative merits of various pay systems; lightly touched upon elementary time-study, planning and "system;" *but not one word about standards!*

Probably ninety per cent. of my hearers have read Taylor's "Shop Management." I wonder how many of them really grasped what Taylor was driving at in the paragraphs I have quoted.

So much for general explanation of what Taylor meant by standards and of their place in scientific management. I shall now endeavor to supply specific and tangible examples to illustrate each class of standards, and, as standards of accomplishment are prone to eclipse all of the others in spite of being dependent upon and in a large measure a natural consequence thereof, I shall discuss them only incidentally.

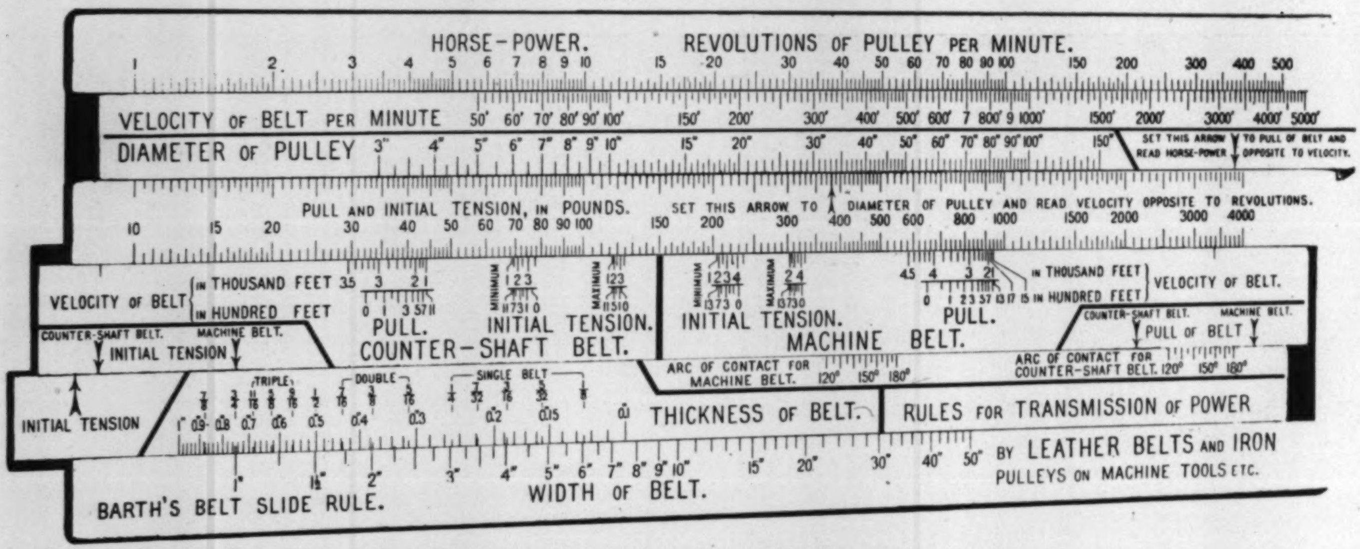

HORSE-POWER.
REVOLUTIONS OF PULLEY PER MINUTE.
VELOCITY OF BELT PER MINUTE
DIAMETER OF PULLEY
SET THIS ARROW TO PULL OF BELT AND READ HORSE-POWER OPPOSITE TO VELOCITY.
PULL AND INITIAL TENSION, IN POUNDS.
SET THIS ARROW TO DIAMETER OF PULLEY AND READ VELOCITY OPPOSITE TO REVOLUTIONS.
VELOCITY OF BELT IN THOUSAND FEET
IN HUNDRED FEET
COUNTER-SHAFT BELT. MACHINE BELT.
INITIAL TENSION
PULL.
INITIAL TENSION.
COUNTER-SHAFT BELT.
MINIMUM
MAXIMUM
MACHINE BELT.
IN THOUSAND FEET
IN HUNDRED FEET
VELOCITY OF BELT.
PULL OF BELT
ARC OF CONTACT FOR MACHINE BELT. 120° 150° 180°
ARC OF CONTACT FOR COUNTER-SHAFT BELT. 120° 150° 180°
INITIAL TENSION
TRIPLE
DOUBLE
SINGLE BELT
THICKNESS OF BELT.
RULES FOR TRANSMISSION OF POWER BY LEATHER BELTS AND IRON PULLEYS ON MACHINE TOOLS ETC.
WIDTH OF BELT.
BARTH'S BELT SLIDE RULE.

FIG. 2. Barth's Belt Slide Rule. Used for computations in establishing and maintaining standard belt conditions.

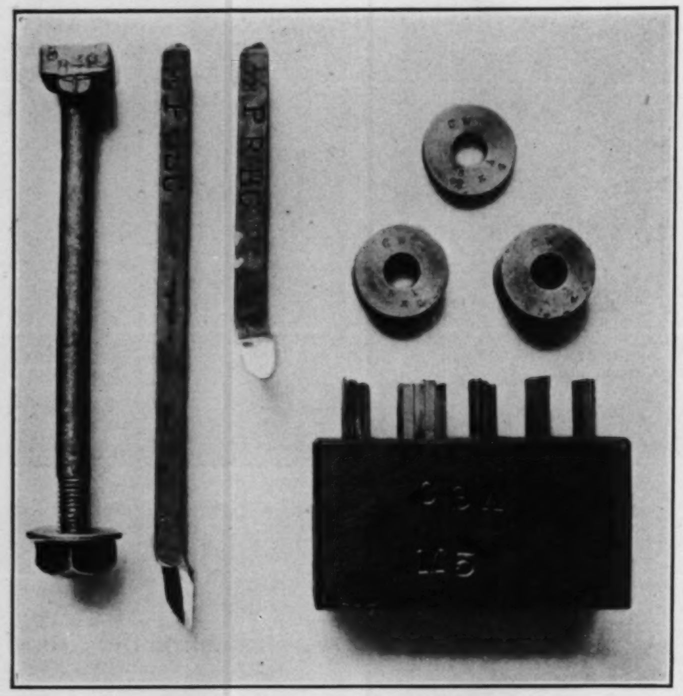


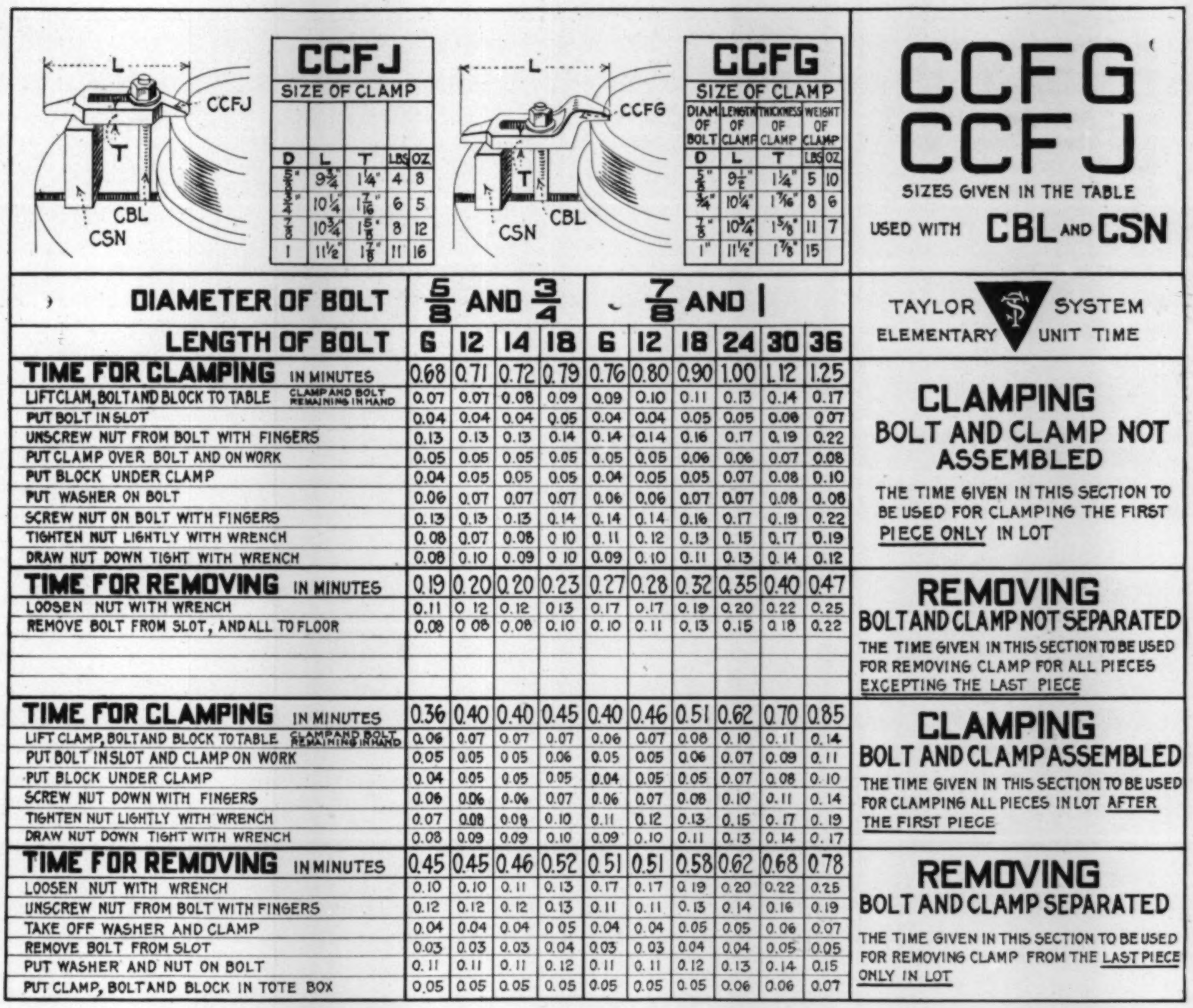
FIG. 4. Standard Tools. Clamping bolt, side tool, round nose roughing tool, washers for belt, set of "shims," or packing pieces, and small wedges.

II STANDARD TOOLS

In describing the results achieved through the application of scientific management in its simplest form to work of an elementary character—that of handling raw materials—such as iron ore, coal, coke, sand and ashes in the yards of the Bethlehem Steel Co., Mr. Taylor gave an illustration of the establishment of a standard that can be understood and appreciated by anyone. He found that the same size and kind of shovel was being used for all of these materials. Almost any ten-year-old child knows that coal is heavier than ashes. It is obvious (since Taylor called our attention to the fact) that a shovel that will be suitable to hold the most economical weight of one material will not be so economical when used for another material of a different weight and character. Taylor's experiments demonstrated that twenty-one pounds is the most economical weight to be handled as a shovelful, and consequently had shovels built for each of the various materials to handle that weight. Of what avail would time study or differential piece work have been in this work without the standard shovel?

A few years ago I was gratified to see the advertisement of a manufacturer of shovels who announced that he would supply a standard twenty-one pound capacity shovel for any material. I doubt, however, whether it brought him much business; to most managers such a tool is too humble to attract their attention—a shovel is a shovel.

But little above the humble shovel is the bolt, clamp and block used by the machinist in fastening work on the platen of his machine, be it planer, milling machine, boring mill, drill press or lathe. In the ordinary machine shop the management does not consider these tools worthy of its attention, each workman is *supposed* to have in some way acquired and to have on hand at his machine an assortment and supply adequate to his needs. It is taken for granted that they are in good condition; that "is up to the workman." As a matter of fact these suppositions are largely fond delusions.


L
CCFJ
T
CBL
CSN
L
CCFG
T
CBL
CSN

CCFJ

SIZE OF CLAMP

D	L	T	LBS	OZ
5/8"	9¾"	1¼"	4	8
3/4"	10¼	1 7/16"	6	5
7/8	10¾"	1 5/8"	8	12
1	11½"	1 7/8"	11	16

CCFG

SIZE OF CLAMP

DIAM. OF BOLT	LENGTH OF CLAMP	THICKNESS OF CLAMP	WEIGHT OF CLAMP	
D	L	T	LBS	OZ
5/8"	9½"	1¼"	5	10
3/4"	10¼"	1 7/16"	8	6
7/8"	10¾"	1 5/8"	11	7
1"	11½"	1 7/8"	15	

CCFG
CCFJ
SIZES GIVEN IN THE TABLE
USED WITH **CBL** AND **CSN**

TAYLOR SYSTEM
ELEMENTARY UNIT TIME

DIAMETER OF BOLT	5/8 AND 3/4				7/8 AND 1					
LENGTH OF BOLT	**6**	**12**	**14**	**18**	**6**	**12**	**18**	**24**	**30**	**36**
TIME FOR CLAMPING IN MINUTES	0.68	0.71	0.72	0.79	0.76	0.80	0.90	1.00	1.12	1.25
LIFTCLAM, BOLT AND BLOCK TO TABLE CLAMP AND BOLT REMAINING IN HAND	0.07	0.07	0.08	0.09	0.09	0.10	0.11	0.13	0.14	0.17
PUT BOLT IN SLOT	0.04	0.04	0.04	0.05	0.04	0.04	0.05	0.05	0.08	0.07
UNSCREW NUT FROM BOLT WITH FINGERS	0.13	0.13	0.13	0.14	0.14	0.14	0.16	0.17	0.19	0.22
PUT CLAMP OVER BOLT AND ON WORK	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.07	0.08
PUT BLOCK UNDER CLAMP	0.04	0.05	0.05	0.05	0.04	0.05	0.05	0.07	0.08	0.10
PUT WASHER ON BOLT	0.06	0.07	0.07	0.07	0.06	0.06	0.07	0.07	0.08	0.08
SCREW NUT ON BOLT WITH FINGERS	0.13	0.13	0.13	0.14	0.14	0.14	0.16	0.17	0.19	0.22
TIGHTEN NUT LIGHTLY WITH WRENCH	0.08	0.07	0.08	0.10	0.11	0.12	0.13	0.15	0.17	0.19
DRAW NUT DOWN TIGHT WITH WRENCH	0.08	0.10	0.09	0.10	0.09	0.10	0.11	0.13	0.14	0.12
TIME FOR REMOVING IN MINUTES	0.19	0.20	0.20	0.23	0.27	0.28	0.32	0.35	0.40	0.47
LOOSEN NUT WITH WRENCH	0.11	0.12	0.12	0.13	0.17	0.17	0.19	0.20	0.22	0.25
REMOVE BOLT FROM SLOT, AND ALL TO FLOOR	0.08	0.08	0.08	0.10	0.10	0.11	0.13	0.15	0.18	0.22
TIME FOR CLAMPING IN MINUTES	0.36	0.40	0.40	0.45	0.40	0.46	0.51	0.62	0.70	0.85
LIFT CLAMP, BOLT AND BLOCK TO TABLE CLAMP AND BOLT REMAINING IN HAND	0.06	0.07	0.07	0.07	0.06	0.07	0.08	0.10	0.11	0.14
PUT BOLT IN SLOT AND CLAMP ON WORK	0.05	0.05	0.05	0.06	0.05	0.05	0.06	0.07	0.09	0.11
PUT BLOCK UNDER CLAMP	0.04	0.05	0.05	0.05	0.04	0.05	0.05	0.07	0.08	0.10
SCREW NUT DOWN WITH FINGERS	0.06	0.06	0.06	0.07	0.06	0.07	0.08	0.10	0.11	0.14
TIGHTEN NUT LIGHTLY WITH WRENCH	0.07	0.08	0.08	0.10	0.11	0.12	0.13	0.15	0.17	0.19
DRAW NUT DOWN TIGHT WITH WRENCH	0.08	0.09	0.09	0.10	0.09	0.10	0.11	0.13	0.14	0.17
TIME FOR REMOVING IN MINUTES	0.45	0.45	0.46	0.52	0.51	0.51	0.58	0.62	0.68	0.78
LOOSEN NUT WITH WRENCH	0.10	0.10	0.11	0.13	0.17	0.17	0.19	0.20	0.22	0.25
UNSCREW NUT FROM BOLT WITH FINGERS	0.12	0.12	0.12	0.13	0.11	0.11	0.13	0.14	0.16	0.19
TAKE OFF WASHER AND CLAMP	0.04	0.04	0.04	0.05	0.04	0.04	0.05	0.05	0.06	0.07
REMOVE BOLT FROM SLOT	0.03	0.03	0.03	0.04	0.03	0.03	0.04	0.04	0.05	0.05
PUT WASHER AND NUT ON BOLT	0.11	0.11	0.11	0.12	0.11	0.11	0.12	0.13	0.14	0.15
PUT CLAMP, BOLT AND BLOCK IN TOTE BOX	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.07

CLAMPING
BOLT AND CLAMP NOT ASSEMBLED

THE TIME GIVEN IN THIS SECTION TO BE USED FOR CLAMPING THE FIRST PIECE ONLY IN LOT

REMOVING
BOLT AND CLAMP NOT SEPARATED

THE TIME GIVEN IN THIS SECTION TO BE USED FOR REMOVING CLAMP FOR ALL PIECES EXCEPTING THE LAST PIECE

CLAMPING
BOLT AND CLAMP ASSEMBLED

THE TIME GIVEN IN THIS SECTION TO BE USED FOR CLAMPING ALL PIECES IN LOT AFTER THE FIRST PIECE

REMOVING
BOLT AND CLAMP SEPARATED

THE TIME GIVEN IN THIS SECTION TO BE USED FOR REMOVING CLAMP FROM THE LAST PIECE ONLY IN LOT

Fig. 3. Elementary Time Study Data Sheets, showing time for putting on and taking off standard bolts, clamps and blocks.

The time that it will take to clamp a job on a machine depends upon:

(1) Whether the bolt, clamp and block to go under the heel of the clamp are readily at hand when wanted; whether they have to be dug out of a heterogenous mass of such tools kept by the workman in the bed of the machine, in a box or locker; whether they have to be "borrowed" from another workman—with or without his consent; whether the workman has to go to the blacksmith shop to get a piece welded on, a bolt to make it long enough, or to the carpenter shop to get a block of the right length cut off, etc., etc.

(2) Whether the head of the bolt available fits the T slot in the machine or has to be ground or filed to let it in; whether the length is just right or it is from one inch to three inches too long, necessitating either finding and putting on washers or old nuts to fill up the gap, or screwing the nut down an inch or two further than should be necessary on a bolt of the *right* length.

(3) Whether the nut fits properly on the bolt so that it may be quickly and easily screwed on or off with the fingers, or whether it is so tight that it must be slowly and laboriously screwed all the way on and all the way off with a wrench.

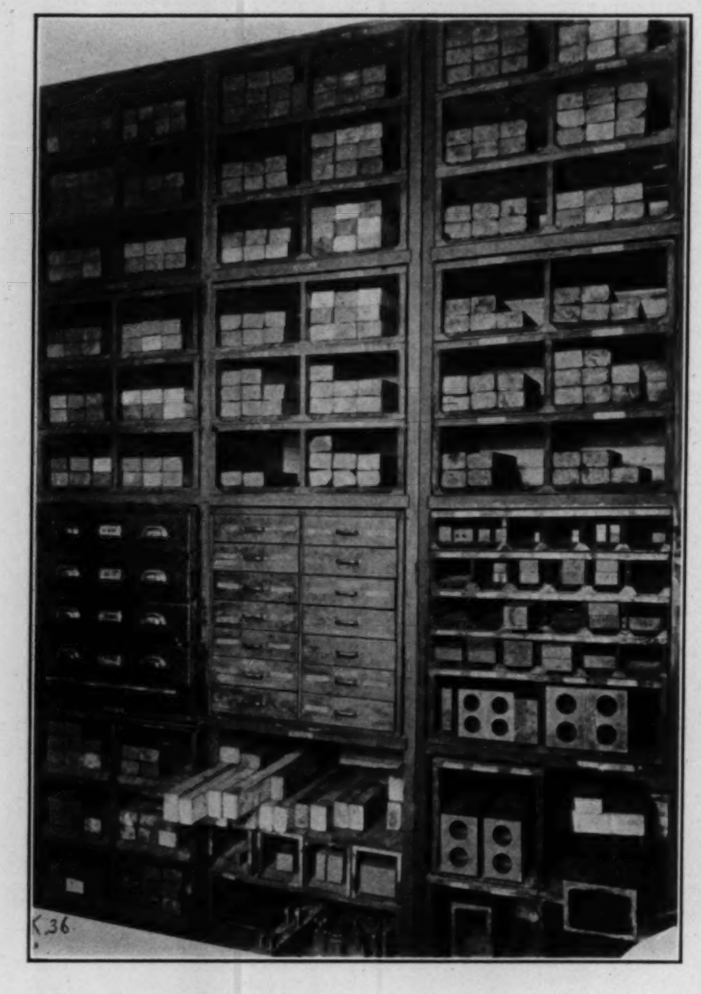


FIG. 5. Section of tool room showing standard wood blocks stored in standard bins.

(4) Whether or not a wrench of the right type and size is readily at hand.

I have seen a machinist whose job was to run a large planer, the time of which was worth not less than three dollars an hour, spend fifteen minutes at a vise trying to loosen up the nut on a bolt that he wanted to use in clamping a job; the noon whistle blew while he was still struggling with it. I don't know how much more time he put in on it after lunch. The bolt was about 1" diameter and 12" long. I would call your attention to plate Fig. 3 showing the time for putting on and taking off standard bolts, clamps, and blocks, from which you will see that for a bolt of the size mentioned the time allowed is eight tenths of a minute.

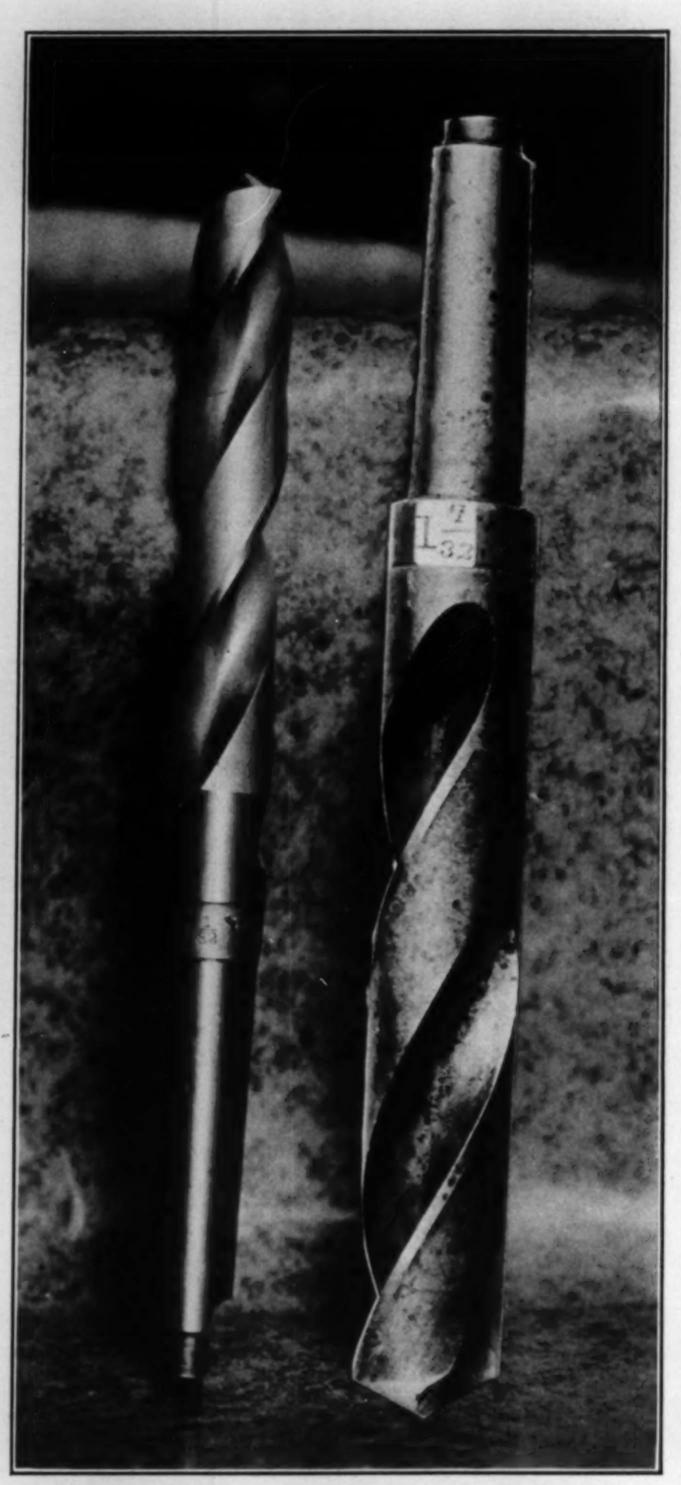


FIG. 6. Twist Drills as ordinarily supplied by maker (left) and as standardized under Taylor practice (right).

In a machine shop run under the Taylor System standard bolts, clamps and blocks in ample assortment and ample quantity are kept in the tool room. In planning a job the number and size required to hold it is decided, the time allowed is entered on the instruction card, and they are called for on the list of tools that will be delivered to the machine in advance for the job; the bolts will be of the right length, as will

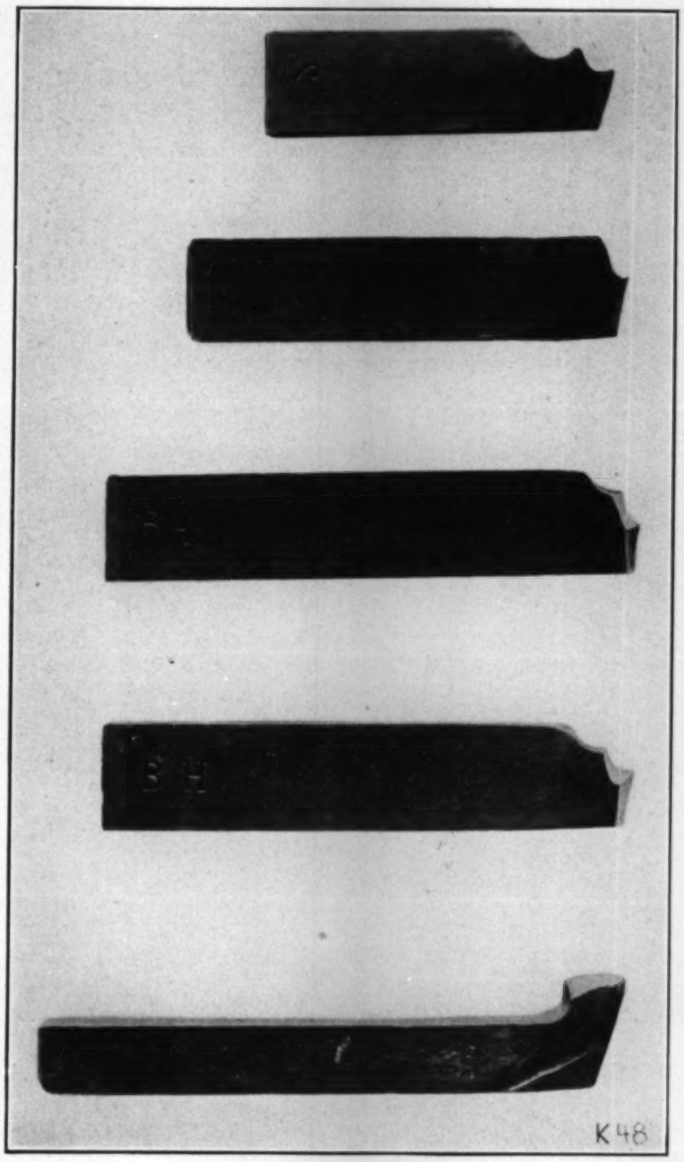


Fig. 7. Lathe Tools (side view). The bottom one is Taylor standard tool-machine ground; the others unstandardized-ground by hand by workmen.

be the wood blocks; the nuts will fit so that they may be screwed on or off with the fingers; and the heads of the bolts will fit the T slots of the machine. Furthermore, a wrench of the right type and size to fit the nut will be issued with the bolts so that the workman will not have to hunt for one, or to use that useful but inefficient tool, a monkey wrench.

Of how much value would the time-study data shown be in a shop in which no standards exist?

I might cite a hundred or more similar illustrations of the advantages of and necessity for standard tools in machine shops, but I think one more will suffice.

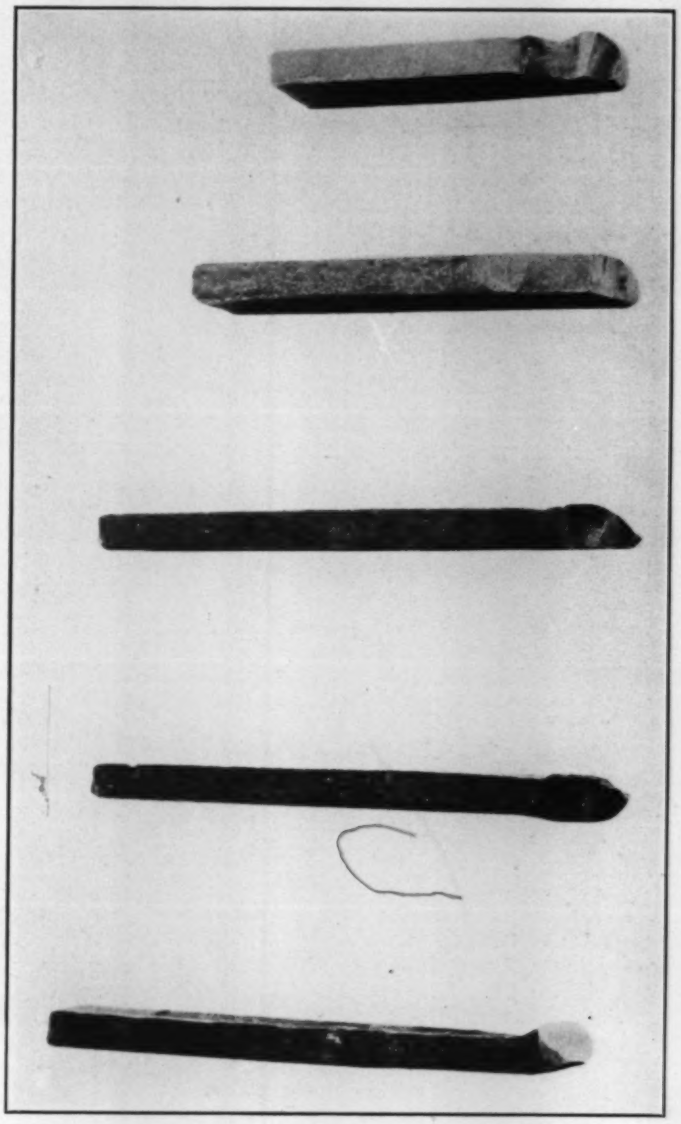


Fig. 8. Lathe Tools (top view of tools shown in Fig. 7).

Some years ago when studies were being made of the handling of twist drills—that is, selecting a drill of the required size from several issued for a job, verifying the size stamped on the body of the drill, putting it into a sleeve to fit the spindle of the drill press, and then into the spindle of the machine, and the reverse of these processes after drilling the hole—I was astonished and perplexed by the lack of uniformity in the time shown by the studies. The same set of elements showed in some observations to have taken two to three times as long as in others. Our analysis located this variation all in one element, that of selecting the drill and verifying the size. This was due, as it proved, to the fact that the makers stamped the size

FIG. 9. Special Machine for Dampening Handkerchiefs.

in small figures, difficult to read, as will be seen on the first drill in the accompanying illustration. They are also upside down with reference to the position occupied by the drill when put into the spindle, which necessitate its being turned end for end by the workman. By filing a good size flat spot on the drill and stamping thereon the size in easily read figures as shown in the photograph we killed two birds with one stone, eliminating the variable element, cutting out a superfluous element and making a proportionally large saving in time. My recollection is that the time saved exceeded the total time required after this feature had been standardized. Another standard adopted in connection with twist drills—the Barth key and keyway for driving—which has replaced in all machine shops operated under the Taylor System and even in some others, the weak and troublesome tang ordinarily furnished by the makers, does not show in the photograph.

Standardization of cutting tools by reason of its primary importance occupied the attention of Taylor, Barth, Gantt and others associated with them over a period of twenty-five or more years during which exhaustive experiment and research continued. The results of these experiments up to 1906 were described by Mr. Taylor in his presidential address before the American Society of Mechanical Engineers and attracted the attention of the foremost engineers and metallurgists of this country and Europe. Mr. Barth has been continuing this research, extending it to other classes of metal cutting such as drilling and milling. While this treatise "On the Art of Cutting Metals" primarily and directly applies to machine shop work, every manager, student of scientific management and management engineer may derive profit from reading and studying it.

As an apprentice I was taught by men ranking as

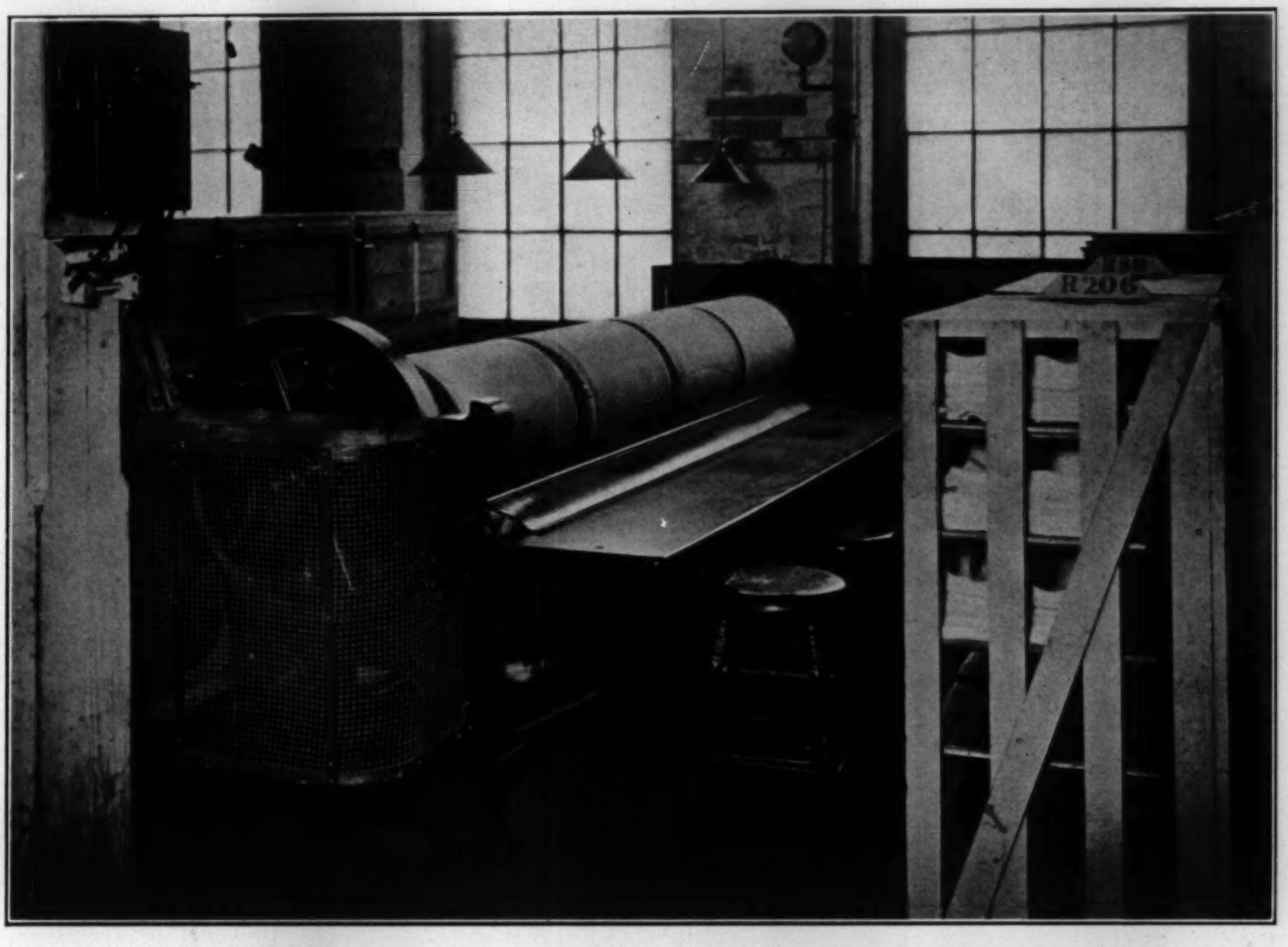


FIG. 10. Standardized Ironing Machine, showing "Damp Closets" containing work to be done, which prevent its drying out; also trucks to receive ironed handkerchiefs. Note pressure gauge on steam pipe leading to machine.

first class mechanics that a tool should be ground with a curved lip in order that when cutting steel the chip would be turned off in a long continuous helix, similar to the curled shaving from the carpenter's plane. This indicated that the tool was "cutting the metal off" with a knife-like action and not "pushing" or wedging it off.

Without going too far into the theory of cutting metals, it was demonstrated by the work of Taylor and his associates that (except for the fine finish cuts) the wedging action is correct in cutting steel or cast iron, the "chip" striking and sliding and breaking up on the top surface of the tool at a point some distance back of the cutting edge. At first the chips are broken off in short pieces, but little by little the chip sliding on the surface of the tool as it comes off wears it to a curve which becomes deeper and wider until it accomplishes what was effected at the start by grinding, as I was taught to do it, and finally the chip comes off in a long continuous helix. When the curve worn by the chip reaches the cutting edge we have a thin wedge section, becoming thinner and thinner until it finally crumbles or is burned away by the heat generated in cutting.

From this I think it will be apparent to you that in grinding a tool in the way the old first-class mechanic taught me to do it, I was simply artificially wearing it out and shortening its cutting life. The result was more frequent changing of tools, at uncertain intervals; more frequent grinding; more frequent dressing and waste of expensive tool steel. Standard cutting tools which under a given set of conditions may be relied upon to cut for a definite length of time are absolutely essential if a definite time is to be set for a job in which the cutting time is computed by Barth's slide rules, and the time for changing tools as well as all other items of hand work is definitely allowed on a basis of elementary time study.

Figures 7 and 8 show four lathe tools all supposedly

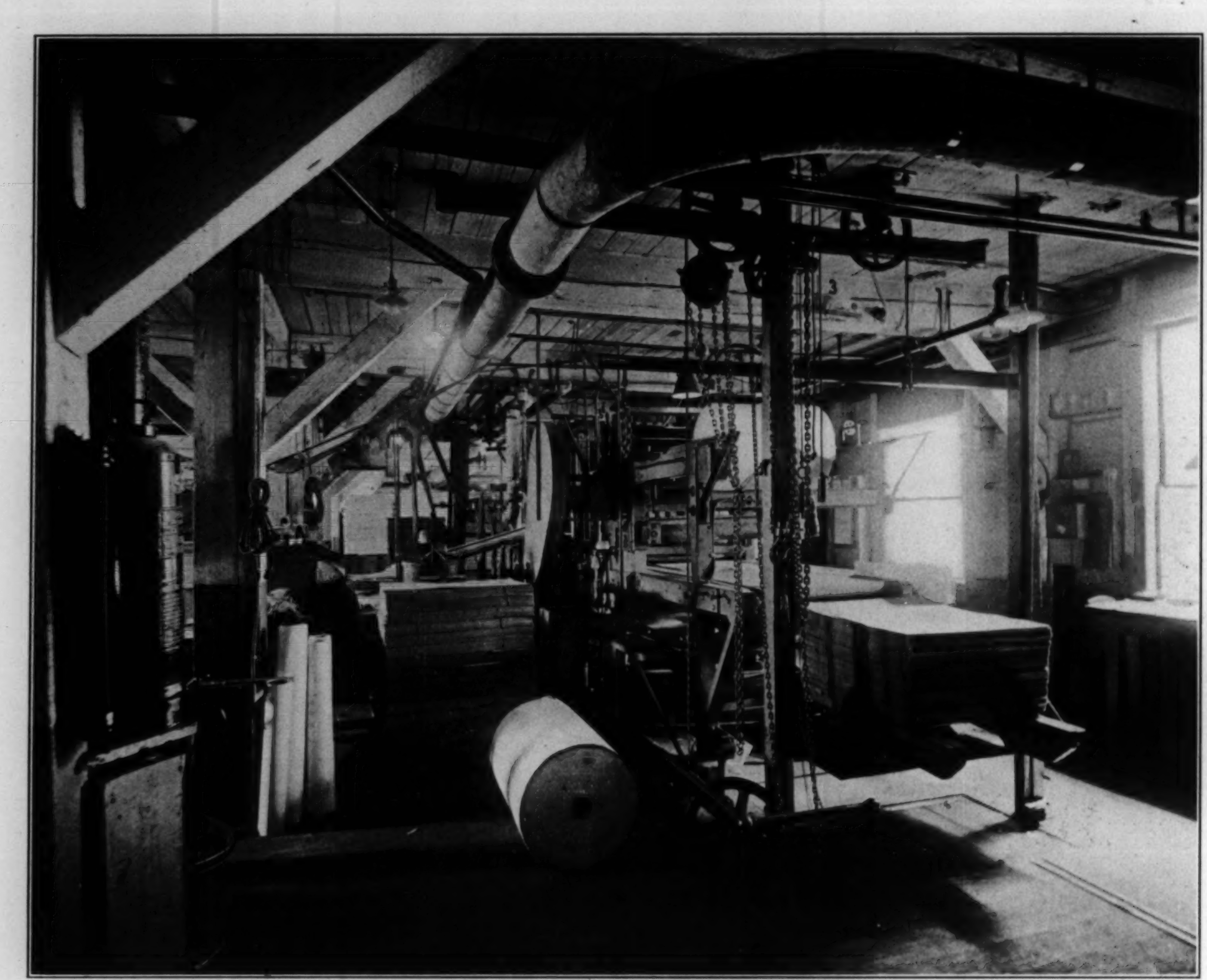


FIG. 11. Machine for Lining Board. Used for making paper boxes after standardization.

the same—or at least used for the same purpose, which were gathered up in a shop in which each man ground his own tools. At the bottom of each photograph is shown a standard tool. It does not take a machinist to understand or appreciate this illustration.

In a plant winding small magnet coils, somewhat similar to those which you have all seen in electric bells, our time studies showed that the operator had to use during the operation, a pair of scissors, a small knife, and a soldering iron. These tools proved to be an important source of lost time and variation in output. The scissors and the knife had always been provided by the operator and there was the greatest possible variation in type, size, quality and condition. No regular provision had been made for keeping them sharp. Our studies enabled us to establish a standard of type, size and quality; from there on the company supplied them and systematically kept them in first-class condition.

While the soldering irons had been supplied by the company, no standard had been established; some of them were about six inches long over all and weighed about half a pound; and from this they ranged in size and weight up to about twelve inches long and two pounds in weight. Imagine a girl using the latter to solder together the ends of a wire $\frac{1}{64}$ of an inch in diameter! Furthermore, it was found that the points of the soldering irons were in many cases badly in need of dressing. Here again we developed a standard of size and shape of the point, and provided for their being inspected at sufficiently frequent intervals and dressed when it was found necessary.

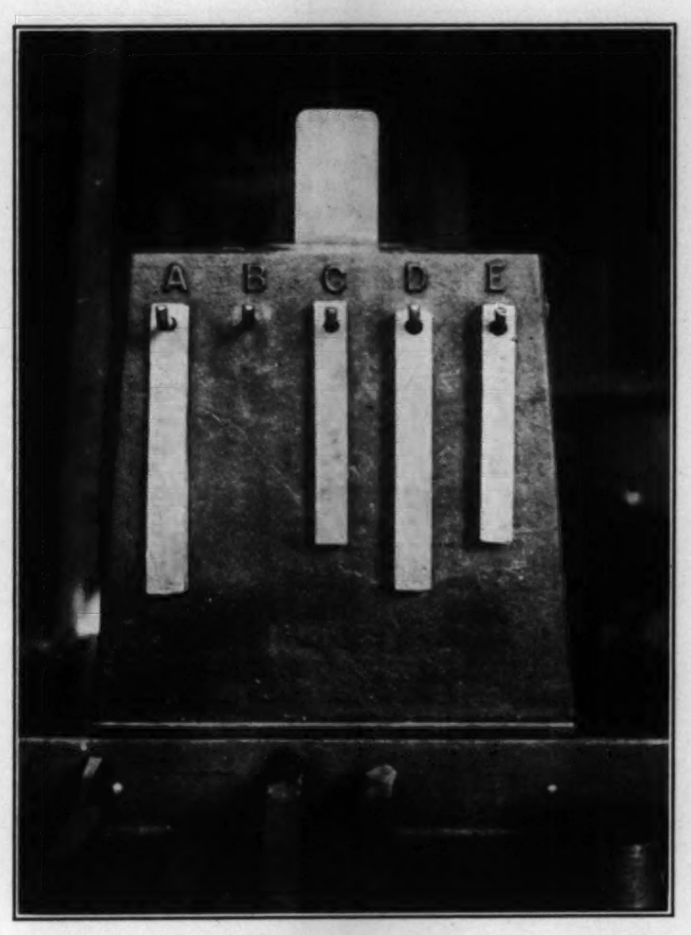


FIG. 12. Height Gauge and Standard Packing Pieces, for facilitating the setting of lathe tools in tool post. (The graduations on the gauge indicating packing pieces to be used do not show clearly.)

Another source of variability in output and of lost time and effort was due to there being provided no regular or suitable place for the operator's tools. This was overcome by providing a board, conveniently located, having a place to hold each of the tools so that when wanted the operator could put her hand on them without even looking. This was only one of the things which enabled the production to be more than doubled, with less effort and less annoyance for the operators, and incidentally enabling her to earn considerably more than she had made on piece work under the old unstandardized conditions.

III STANDARDIZATION OF MACHINES

The most general lack of standards will be found in the speeds at which machines are operated. In a mill in which literally thousands of identical machines were engaged on exactly the same work, variations of over ten per cent were found in the speeds of line shafts driving different groups. In view of the fact that these were continuous process machines, the importance of the loss from this single source will be evident.

In a handkerchief factory, when we started to make time studies, preparatory to putting the operation of machine ironing on task and bonus, we found that the machine speeds varied sixty per cent between the lowest and the highest. With other conditions standardized the higher speed was found to be satisfactory. It was also found that no particular attention was paid to the pressure of the steam supplied for heating the machines, and consequently it fluctuated over a wide range during the day with a corresponding fluctuation in the temperature; some of the machines were equipped with traps for removing any water from the steam and some were not. These did not seem to be matters of any importance while the work was being done on ordinary day work; some of the girls produced less than others, but that was regarded as inevitable; "some operators are good and some not so good" was the accepted explanation. After standardizing these conditions—as well as the preceding operation, that of dampening—the production was increased one hundred per cent, the operator's earnings increased one hundred sixty per cent, while their work was made easier and more agreeable.

The studies and work required to accomplish this extended over a period of more than six months. They involved the determination of laws governing the absorption and evaporation of moisture by each of the wide variety of fabrics from which handkerchiefs are made, the development of a special machine for controlling the amount of water supplied to the handkerchiefs, and of a "damp closet" in which they were stored to permit even diffusion of the water by capillary attraction and to prevent excessive evaporation while stored at the machine waiting to be ironed. Figure 9 shows the machine for "dampening" and Figure 10 a standardized mangle or ironing machine with its "damp closet" and standard trucks for receiving the work as ironed and transporting it to the next operation.

In a paper box factory similar studies and the establishment of standards in connection with a board lining machine—i. e., a machine for covering pasteboard with white paper—resulted in increasing the output one hundred and fifty per cent and enabling two men to operate the machine instead of three, as well as in effecting a considerable saving in indirect labor cost.

This is one of the best examples of machine standardization resulting from real elementary time study

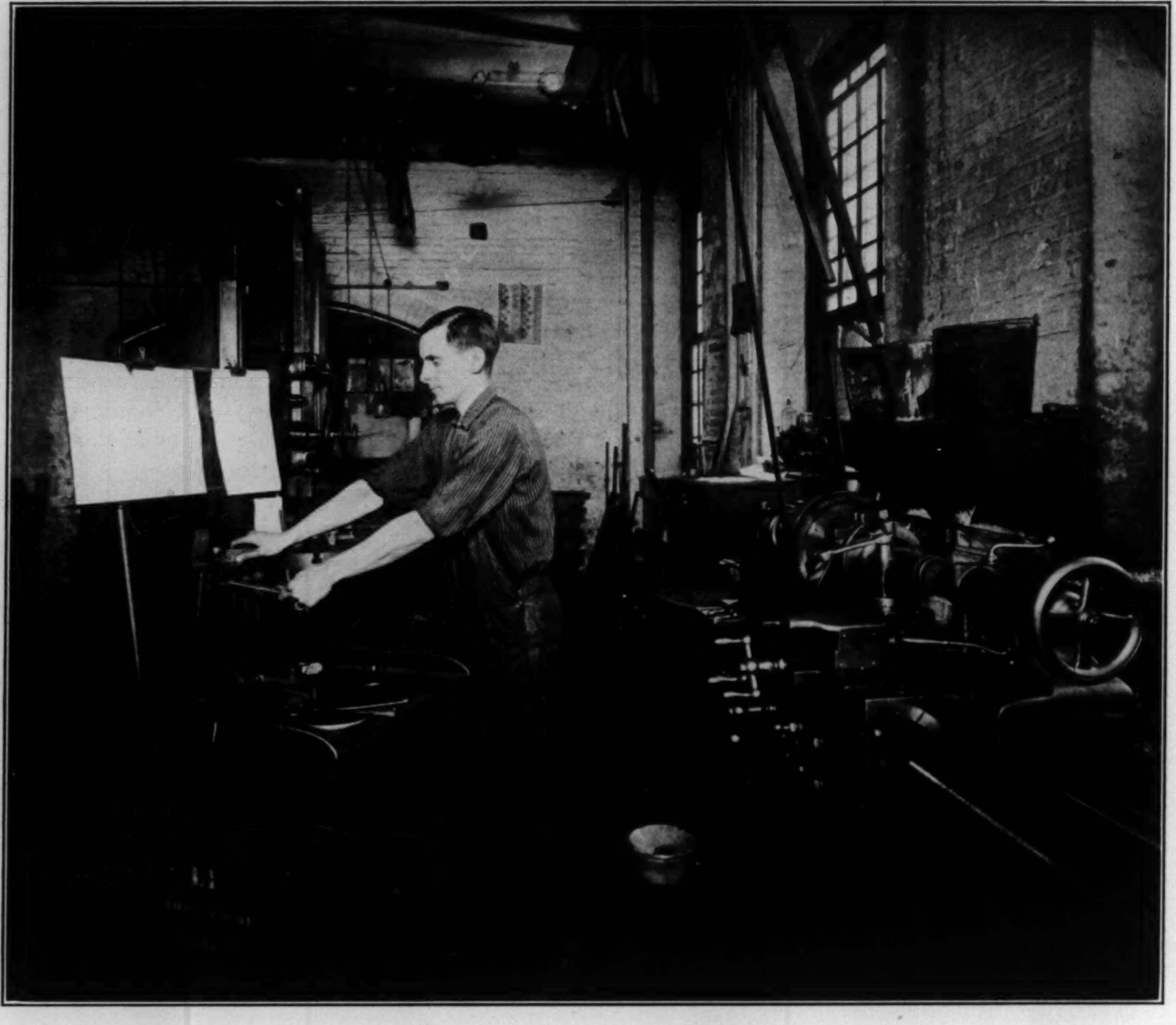


FIG. 13. Tool Stand, with the height gauge and packing piece racks and rack for holding drawing and instruction card for work in progress.

made by a competent time-study man whose work ranks with the best. His report made at the time is worthy of careful attention for it shows the pains and perseverance called for:

On applying time study to the lining machine several changes were found necessary to get the machine into proper condition for applying the task and bonus. Formerly the procedure for loading the elevator of this machine, which rested about 6" above the floor at its lowest point, was to bring a load of board to the elevator and then re-pile it on the elevator. We have sunk the feeding elevator of this machine into the floor on a level with the floor, so that a Cowan platform of loaded board can be rolled right on to the elevator with a Cowan truck.

Time study showed that the manner in which a roll of paper was made ready for the job being run on the lining machine was wrong, it being done as follows:

There was a shaft with square-faced cones. The object of these square-faced cones was to drive the corners into the wooden cores of the paper rolls, but as our paper here has not come with wooden cores for the last few years past, it has been found that these square cones from the constant driving into the iron cores, which are now supplied in the rolls of paper, have worn the corners off from those square cones, so that the man making the roll of paper ready has to drive wooden wedges in to secure the rolls of paper tightly to the reel shaft. There was also an inadequate friction brake on the end of the shaft, held together by means of a carpenter's C clamp in order to get the proper tension required to pull this paper smoothly over the paste rolls.

It was deemed advisable to have a new reel shaft made. This in turn suggested another idea, that of having two reel rods and always having the next roll of paper needed ready and resting on extra brackets, which were provided at this time to hold the next roll of paper to be used on the machine. It was the previous custom when the roll of paper ran out to stop the machine and all hands start to make the next roll

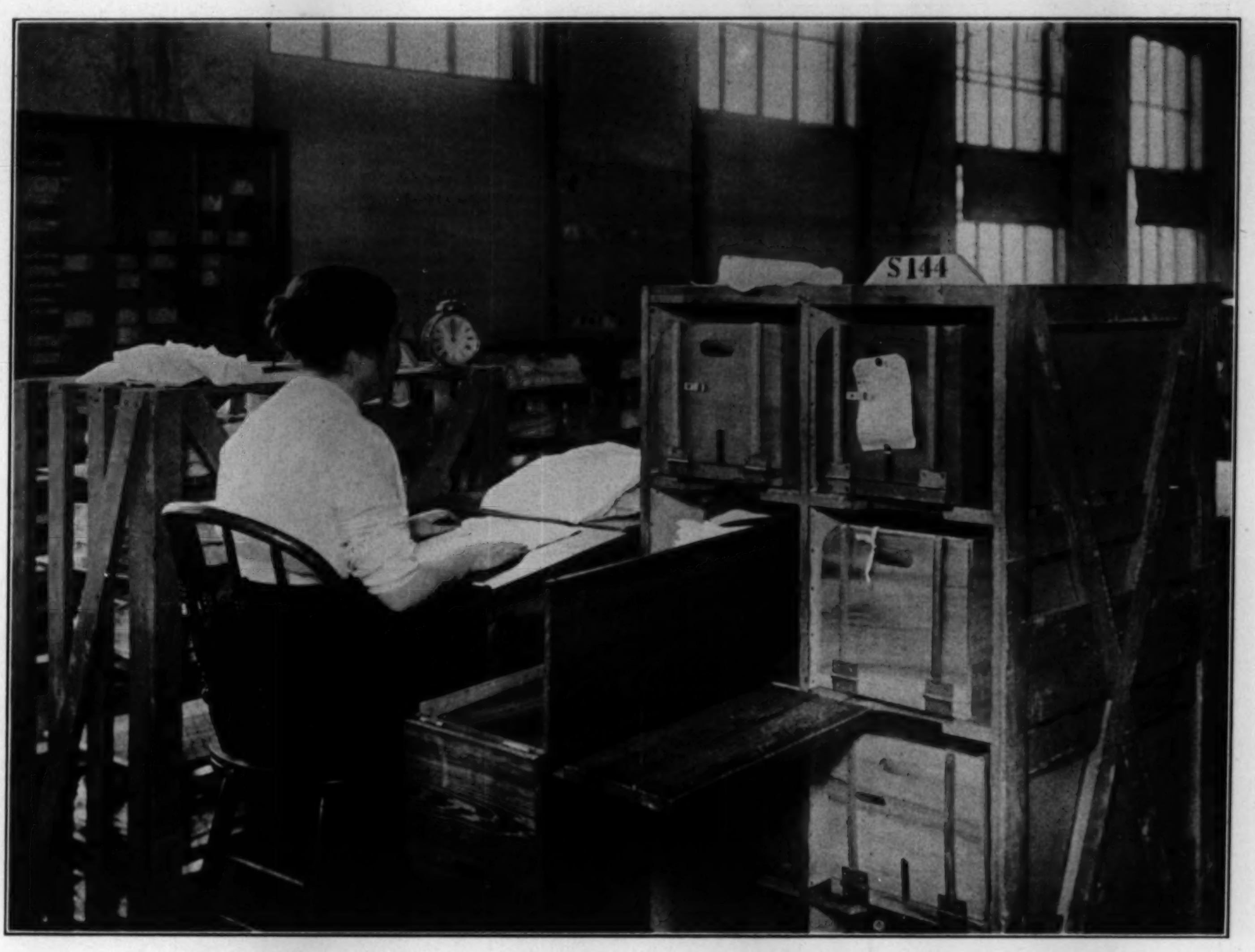


Fig. 14. Standard Work-place, Trucks and Containers for Folding Handkerchiefs.

of paper ready. At the present time, with the use of the new roll rods, the machine tender will make the next roll ready while the machine is running.

It has also been found necessary in connection with the raising of the rolls of paper on the machine, owing to the height between the top of the machine and the ceiling, to have a set of tongs made which will enable us to get a very short hitch with the tackle blocks on the roll of paper. Before, a rope sling was used, and by the time the roll had been drawn up into the machine there would be slack enough occasioned by the stretch of the rope sling so that the roll could not be pulled up high enough to get it on the bearings of the machine; so it was usually the custom to call four or five men in and all hands boost the roll up on to the bearings.

Another condition which showed up at this time was the fact that sometimes at the finish of an order there would be quite a sizable roll of paper left on the machine, it being too heavy for the machine tender and move man to remove from the machine. It has been found necessary to provide another track on the ceiling directly over where this roll would be resting, to enable us to lift this roll off with the tackle block. We could not use the track that the next roll ready is raised by, because it is some two feet back of the center of the roll that is being used.

Time study on this machine has also shown that it is advisable, if the scheme is practical, to feed the sheets of board into the lining machine the narrow way of the sheet instead of the long way of the sheet. The gain in sheets (ranging approximately from ten per cent to fifty per cent) against each size of board run per minute is shown on report made relative to changing the sizes of lining paper. In order to accomplish this end it was found necessary to put a wider canvas on the lining machine, the width of the canvas then used being 36". This width could not be used any longer, as the longest sheet of board that we would need to run in the machine would be 38". In order to get a canvas to accommodate these 38" sheets, it was thought best to provide one the full face of the rolls, which is 40", and in doing this it meant that we had to reconstruct the guides which caused this canvas to run in the center of the machine and not traverse from side to side.

It was also found necessary in connection with the running of the sheets the opposite way in the machine to provide a new side gauge. This should have been done sometime ago, as the gauge that was on was in a dilapidated condition; and in order to feed these sheets into the machine the narrow way, it was necessary to bring the end roll next to the feeder back towards the feeder a distance of about 18", so that feeder could reach the feed-in canvas.

Having received the new width canvas and installed it on the machine, we decided to make a run of the five sizes of board that we could use, the longest rolls of lining paper that we had, to see what the effect would be on the board of running it the grain with the circumference of the rolls. We

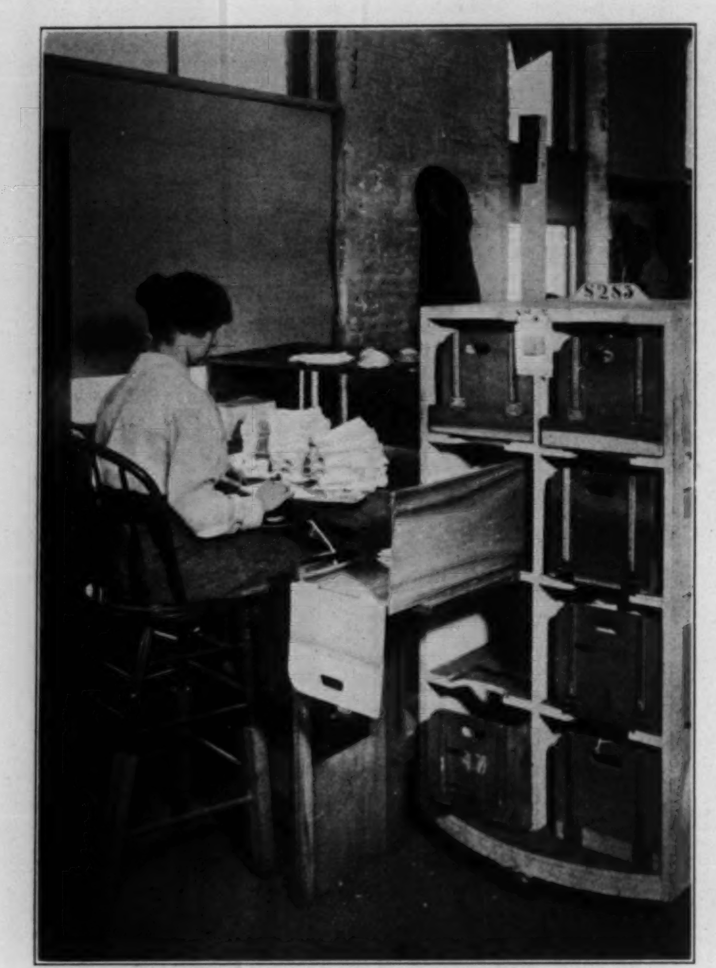


FIG. 15. Standard Work Place for "Ribboning" Handkerchiefs. Note the "Spring Chair" developed by Frank B. Gilbreth. The legs rest on springs in the extensions to eliminate floor vibration and any consequent discomfort or fatigue.

soon found out after starting this that the sheets came out of the machine badly curled, so much so that it was almost impossible to pile them, to say nothing of the trouble that might be occasioned at the scoring machines later on. Rather than discard the idea of running these sheets this way and returning to the old way, we raised the canvas coming off the last drier about 2′, running it over a 4½″ roll instead of a 7″ roll, and placing two iron rolls on the top of this one, thereby bending the board over a small diameter roll in the opposite direction from what the board is curled, coming from the large drier. This attachment is running at the present time, and the board is coming from the machine straighter than it did under the old system of running the sheets in the machine the old way; but it was found that in bringing the sheets down to the man breaking at the end of the machine vertical instead of coming out to him horizontally, it inconvenienced the breaker so that it has been decided to put an automatic cut-off on to this machine, most of the apparatus for which is on hand in the plant at the present time.

Another adjustment which was found necessary in connection with the operation of this machine was one which would raise the paper off from the paste roll when the machine would be stopped to reload the elevator. The previous custom was to break the paper off by hand after the load which was on the elevator had been run and then re-thread the machine. This appliance is now on the machine, and shows a saving of one-half the time.

The conclusions to be drawn from this report are as follows:

The second track to go on the ceiling has arrived but has not been put in place. The inside gauge is being made at the Chapel Machine Shops. New tongs for lifting the paper rolls are forged up and in the machine shop. New reel rods are made and are in use. The elevator has been lowered even with the floor to receive the Cowan truck load of board. A new canvas is running on the machine at the present time.

As soon as the rest of the alterations are made on this machine and the new sizes of lining paper have arrived, there is no reason why the task and bonus cannot be immediately applied.

Any one of the examples cited above would in itself furnish the substance for a paper.

Machine shop practice affords a rich field for machine standardization and in this field Mr. Barth's work is preeminent.

Two machine tools of the same size and presumably of the same capacity built by different makers will be found to vary greatly in the range of speeds and feeds provided and in pulling power. It is highly desirable —more obviously so under scientific management— that they should be the same, or as nearly so as possible, in order that jobs may be routed to either one indiscriminately and done as efficiently in one as the other, the same instruction cards and the same tool lists serving either one. By judicious and inexpensive changes in pulleys, belts and gears, Mr. Barth not only brings this about, but what is of greater importance, provides a range of speeds, of feeds and of pulling power suited to the predominating product, taking into account size, material and kind of work, in place of the combination provided by the maker which aimed to provide for *everything* within the machine's capacity, from the largest to the smallest. For example in a 24″ engine lathe one may turn a piece 24″ in diameter or ½″ in diameter but it is not good practice to do either, therefore, why try to provide speeds suitable for these extremes at the expense of speeds for the range of diameters that should properly and will as a rule be handled in a machine of that size?

Bolt slots for clamping work on the tables of drill presses, milling machines and boring mills and on the face plates of lathes seem to have been a detail considered of little importance by machine designers. Two different machines built by the same maker will be found to take bolts of the same diameter but with heads of a different size; two machines of the same kind and size built by different makers will be found to call for bolts different in diameter as well as in the dimensions of the heads. I have even seen a drill press with slots provided to take bolts ¾″ in diameter,

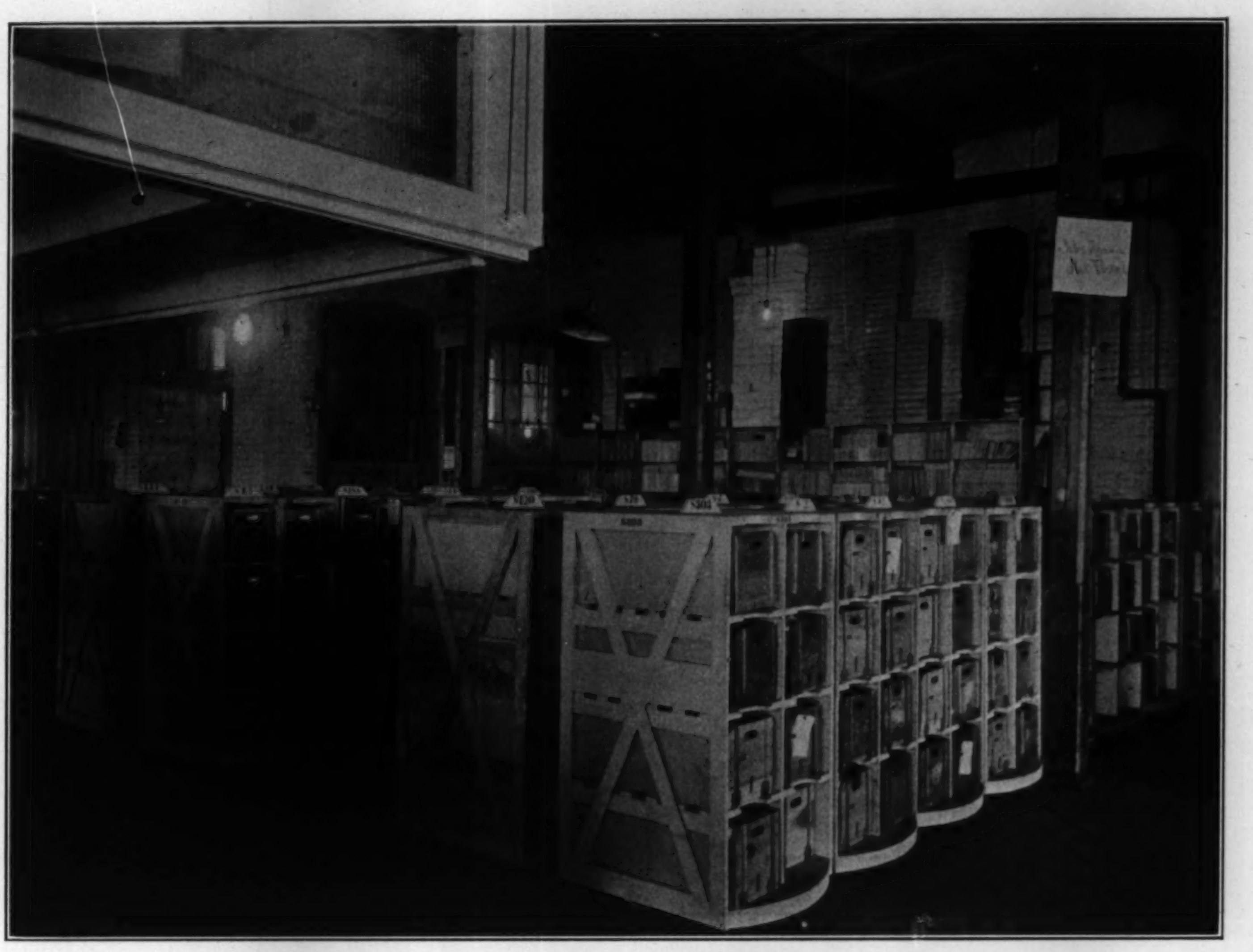


FIG. 16. Truck Station.

but a different size head in the table from that provided for in the base plate.

From what I have said about bolts under the head of standard tools, I think you will appreciate the difficulties, the loss of time and of production which such an unstandardized condition entails. Even supposing that a supply of ordinary bolts for each machine were kept in the tool room, resulting in a much larger stock and more work in the tool room, that they were kept in first-class condition and issued to the machines as required in advance for each job, we would nevertheless find that owing to the poor proportions of the head they would frequently break or damage the slots on the table.

On this account it is the practice as one of the preliminary steps in installing the Taylor System in a machine shop to plane out the slots in all machines to take the strong standard bolt developed by Mr. Barth.

Still another excellent and simple illustration of machine standardization in a machine shop is in the tool posts of small and medium size engine lathes. Until quite recently and still in many instances, the tool post with its concave or cupped washer and sliding shoe furnished with the machine was intended to be used with a tool simply cut off from the bar of steel, the end trimmed roughly to shape and ground. Now the Taylor standard tool, as will be seen by referring back to Figure 7, has a nose turned up considerably above the top surface of the bar, facilitating grinding and affording an increased number of grindings before the tool must be dressed, with, as a consequence, less waste of tool steel. In all cases where necessary the toll post and in some cases the slide rest are altered to permit the use of standard tools; usually this results in reducing the number of sizes of tool steel that have to be used. A more direct gain is obtained, however,

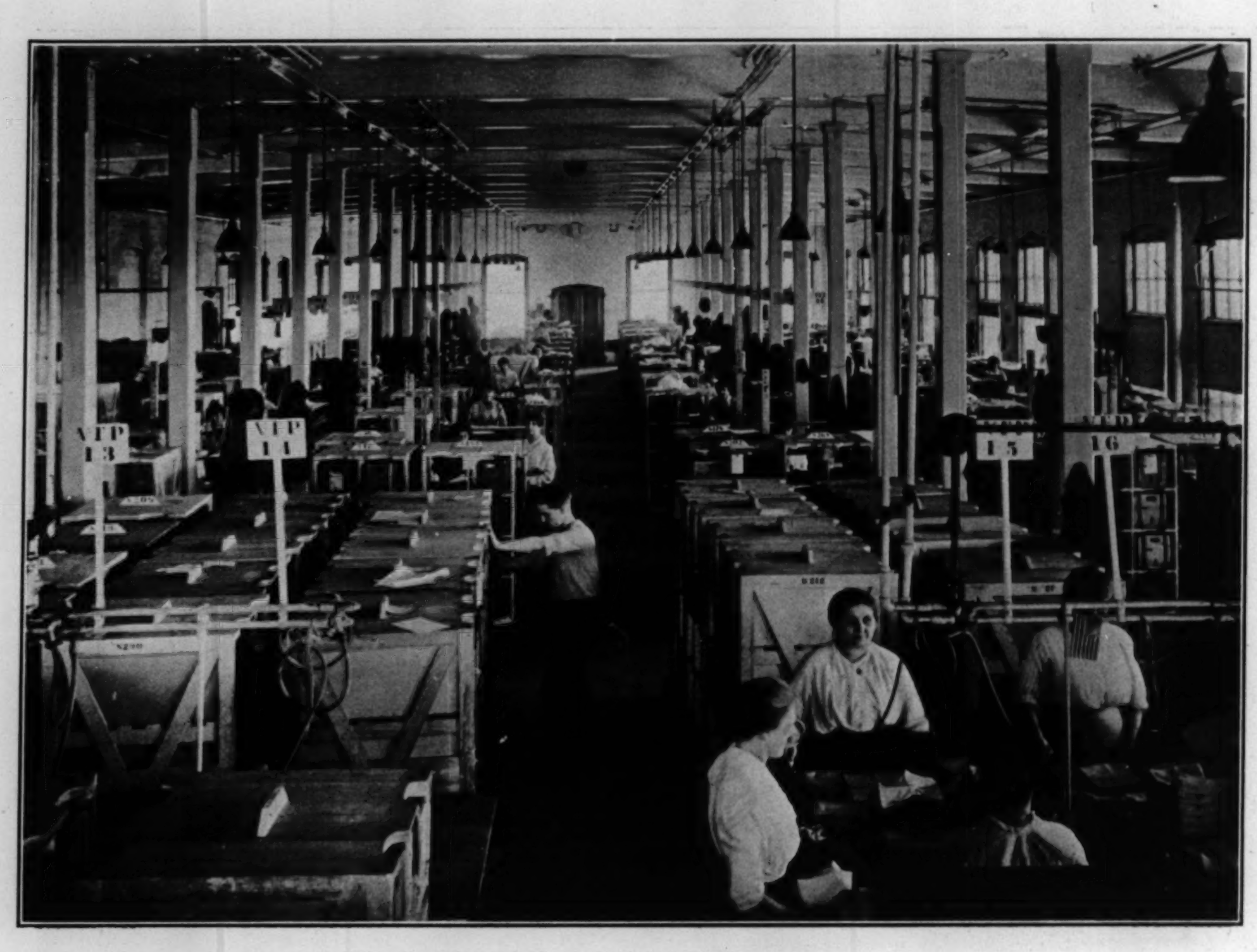


FIG. 17. General view of Folding Department.

by doing away with the cupped washer and sliding shoe and substituting therefore a flat washer with flat packing pieces to be placed under the tool.

To make this clear it is necessary that I explain that the cutting edge of a tool used on cylindrical work be set approximately on, or slightly above, the horizontal radial axis of the work and that the front of the tool clear slightly a tangential line drawn from the point at which the edge of the tool touches the work. The front of a Taylor standard tool is ground to an angle of six degrees from a perpendicular to the base, just enough so that the front of the tool will bear on the work only on the cutting edge; consequently it should be set with the cutting edge just on the horizontal axis of the work—"on the center," as a machinist would say. If a tool is ground with a greater angle of clearance—as is almost inevitable with a tool ground by hand on an emery wheel of relatively small diameter (and it is not unusual to see such tools ground with from 15° to 20° clearance)—one of two things must be done. Either it must be set with the cutting edge above the center or horizontal axis of the job so that the circumferential arc of the work will neutralize the excessive clearance, or it must be tilted, the base being on an angle to the horizontal, which accomplishes the same effect. The cupped washer and sliding shoe accomplishes both at once, tilting the tool and raising the edge. It is in fact quite an ingenious device. However there is one very serious objection to it; the proper setting of the tool is a matter of judgment and of cut and try, calling for more skill and better judgment than is possessed by many workmen and very liable to be a source of delay, or at least uncertainty in the time of an important element.

All of this uncertainty is eliminated by the flat washer and packing pieces replacing the cupped washer and sliding shoe, and by the provision of a measuring device which quickly indicates the number and

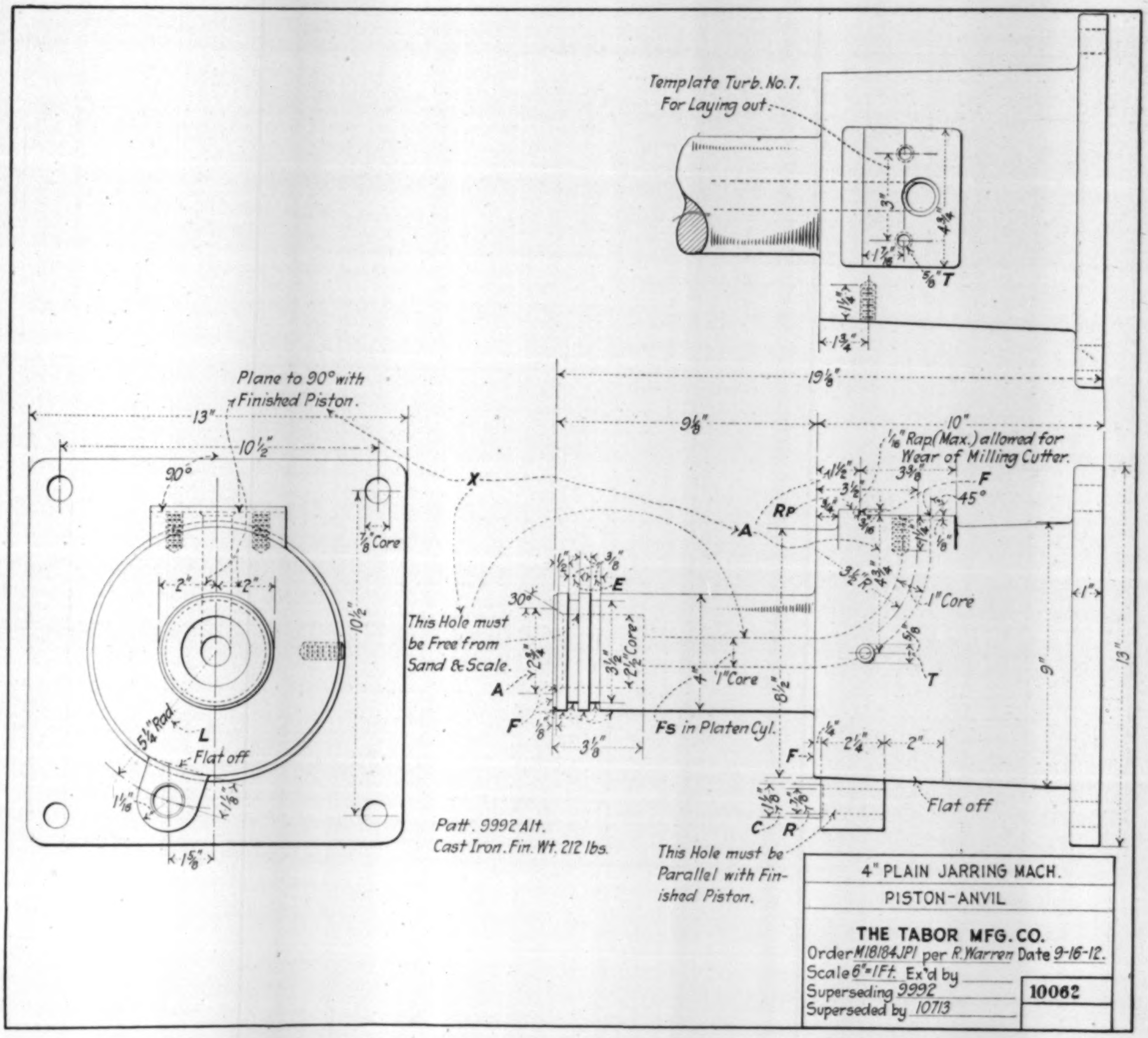
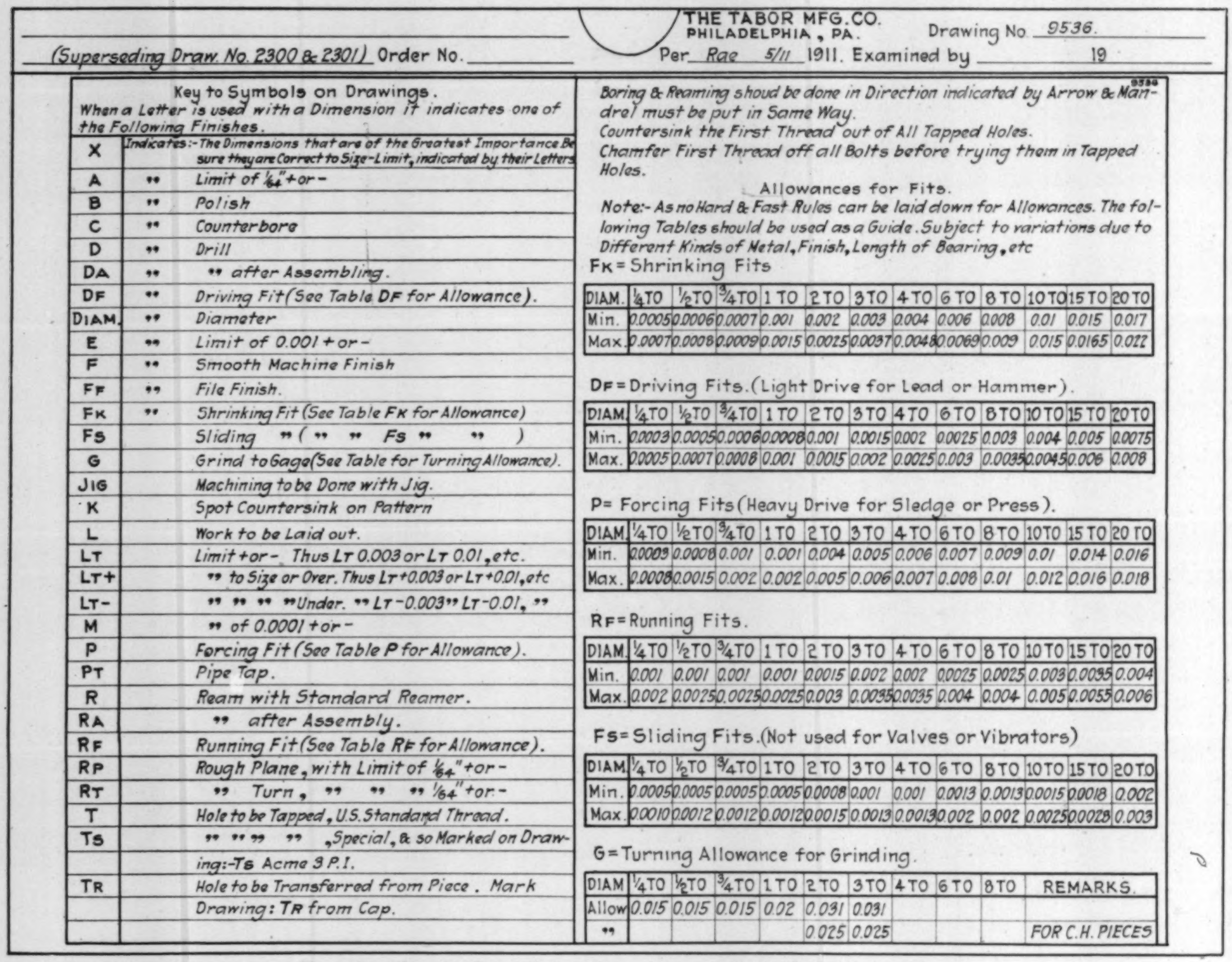


FIG. 18. Drawing showing symbols and notes indicating kind of finish, degree of accuracy, special tools to be used, etc.—nothing left to chance.

thickness of packing pieces that must be placed under the tool, to compensate for variation in height from base to cutting edge due to grinding, and to bring the cutting edge in contact with the work at the right point. This is another standard for which we are chiefly indebted to Mr. Barth.

Under the unstandardized conditions described it is impossible to make a definite allowance for this elementary operation, which on the average must be performed several times during each job. Under the standardized conditions it not only may be depended upon to take the same time each time it is done, but it may be done in less time. A description of this device, of which there are several forms all essentially the same, is, I think, worth while, as it may suggest something similar in other directions. The measuring device with hooks, holding packing pieces, shown by Figure 12, is mounted on the tool stand supplied for the lathe. The tool is picked up from the stand and placed on its base with the cutting edge against the scale. The graduation indicates by direct reading the packing pieces or pieces required, which are picked off their hooks and placed with the tool in the tool post. If the cutting edge comes to the top graduation—



THE TABOR MFG. CO.
PHILADELPHIA, PA.
Drawing No. 9536.
(Superseding Draw. No. 2300 & 2301) Order No.
Per Rae 5/11 1911. Examined by 19

Key to Symbols on Drawings.
When a Letter is used with a Dimension it indicates one of the Following Finishes.

X	Indicates:- The Dimensions that are of the Greatest Importance Be sure they are Correct to Size-Limit, indicated by their Letters	
A	"	Limit of 1/64" + or −
B	"	Polish
C	"	Counterbore
D	"	Drill
DA	"	" after Assembling.
DF	"	Driving Fit (See Table DF for Allowance).
DIAM.	"	Diameter
E	"	Limit of 0.001 + or −
F	"	Smooth Machine Finish
FF	"	File Finish.
FK	"	Shrinking Fit (See Table FK for Allowance)
FS		Sliding " (" " FS " ")
G		Grind to Gage (See Table for Turning Allowance).
JIG		Machining to be Done with Jig.
K		Spot Countersink on Pattern
L		Work to be Laid out.
LT		Limit + or − Thus LT 0.003 or LT 0.01, etc.
LT+		" to Size or Over. Thus LT+0.003 or LT+0.01, etc
LT−		" " " " Under. " LT−0.003 " LT−0.01, "
M		" of 0.0001 + or −
P		Forcing Fit (See Table P for Allowance).
PT		Pipe Tap.
R		Ream with Standard Reamer.
RA		" after Assembly.
RF		Running Fit (See Table RF for Allowance).
RP		Rough Plane, with Limit of 1/64" + or −
RT		" Turn, " " " 1/64" + or −
T		Hole to be Tapped, U.S. Standard Thread.
TS		" " " " , Special, & so Marked on Drawing:- TS Acme 3 P.I.
TR		Hole to be Transferred from Piece. Mark Drawing: TR from Cap.

9536

Boring & Reaming shoud be done in Direction indicated by Arrow & Mandrel must be put in Same Way.
Countersink the First Thread out of All Tapped Holes.
Chamfer First Thread off all Bolts before trying them in Tapped Holes.

Allowances for Fits.

Note:- As no Hard & Fast Rules can be laid down for Allowances. The following Tables should be used as a Guide. Subject to variations due to Different Kinds of Metal, Finish, Length of Bearing, etc

FK = Shrinking Fits

DIAM.	¼ TO	½ TO	¾ TO	1 TO	2 TO	3 TO	4 TO	6 TO	8 TO	10 TO	15 TO	20 TO
Min.	0.0005	0.0006	0.0007	0.001	0.002	0.003	0.004	0.006	0.008	0.01	0.015	0.017
Max.	0.0007	0.0008	0.0009	0.0015	0.0025	0.0037	0.0048	0.0069	0.009	0.015	0.0165	0.022

DF = Driving Fits. (Light Drive for Lead or Hammer).

DIAM.	¼ TO	½ TO	¾ TO	1 TO	2 TO	3 TO	4 TO	6 TO	8 TO	10 TO	15 TO	20 TO
Min.	0.0003	0.0005	0.0006	0.0008	0.001	0.0015	0.002	0.0025	0.003	0.004	0.005	0.0075
Max.	0.0005	0.0007	0.0008	0.001	0.0015	0.002	0.0025	0.003	0.0035	0.0045	0.006	0.008

P = Forcing Fits (Heavy Drive for Sledge or Press).

DIAM.	¼ TO	½ TO	¾ TO	1 TO	2 TO	3 TO	4 TO	6 TO	8 TO	10 TO	15 TO	20 TO
Min.	0.0003	0.0008	0.001	0.001	0.004	0.005	0.006	0.007	0.009	0.01	0.014	0.016
Max.	0.0008	0.0015	0.002	0.002	0.005	0.006	0.007	0.008	0.01	0.012	0.016	0.018

RF = Running Fits.

DIAM.	¼ TO	½ TO	¾ TO	1 TO	2 TO	3 TO	4 TO	6 TO	8 TO	10 TO	15 TO	20 TO
Min.	0.001	0.001	0.001	0.001	0.0015	0.002	0.002	0.0025	0.0025	0.003	0.0035	0.004
Max.	0.002	0.0025	0.0025	0.0025	0.003	0.0035	0.0035	0.004	0.004	0.005	0.0055	0.006

FS = Sliding Fits. (Not used for Valves or Vibrators)

DIAM.	¼ TO	½ TO	¾ TO	1 TO	2 TO	3 TO	4 TO	6 TO	8 TO	10 TO	15 TO	20 TO
Min.	0.0005	0.0005	0.0005	0.0005	0.0008	0.001	0.001	0.0013	0.0013	0.0015	0.0018	0.002
Max.	0.0010	0.0012	0.0012	0.0012	0.0015	0.0013	0.0013	0.002	0.002	0.0025	0.0028	0.003

G = Turning Allowance for Grinding.

DIAM	¼ TO	½ TO	¾ TO	1 TO	2 TO	3 TO	4 TO	6 TO	8 TO	REMARKS.
Allow	0.015	0.015	0.015	0.02	0.031	0.031				
"					0.025	0.025				FOR C.H. PIECES

FIG. 19. Key to Symbols on Drawings of Fig. 18.

marked *O*—as might be the case with a new tool, no packing is required. If it comes to line *A* packing piece *A* is required; if line *AB* packing pieces *A* and *B* are required.

The tool stand itself is an interesting example of standardization. It will be noted by reference to Figure 13 that it provides places for not only the tools for the job in process and jobs ahead but also for the drawings, instruction cards, etc. There is no uncertainty as to where they are and no time lost in finding them when wanted.

The establishment and maintenance of standards in connection with leather belts for transmitting power is an essential feature of machine standardization. It ought to be so well known and understood as to require no reference here. At any rate it would require more time and space than may be devoted to it. I would refer those who may desire complete information on the subject to the following literature:

"Notes on Belting," a paper presented at the December, 1893, meeting of the American Society of Mechanical Engineers, by F. W. Taylor.

"The Transmission of Power by Leather Belting," a paper presented January 12, 1909, at a meeting of the American Society of Mechanical Engineers, by Mr. Carl G. Barth. Attention is directed to the discussion of this paper by Mr. Walter C. Allen, by Mr. F. A. Waldron and by the writer, describing the practical application of the work of Mr. Taylor and Mr. Barth.

"A Practical Solution of the Belting Problem," a pamphlet issued by the Tabor Manufacturing Company, Philadelphia.
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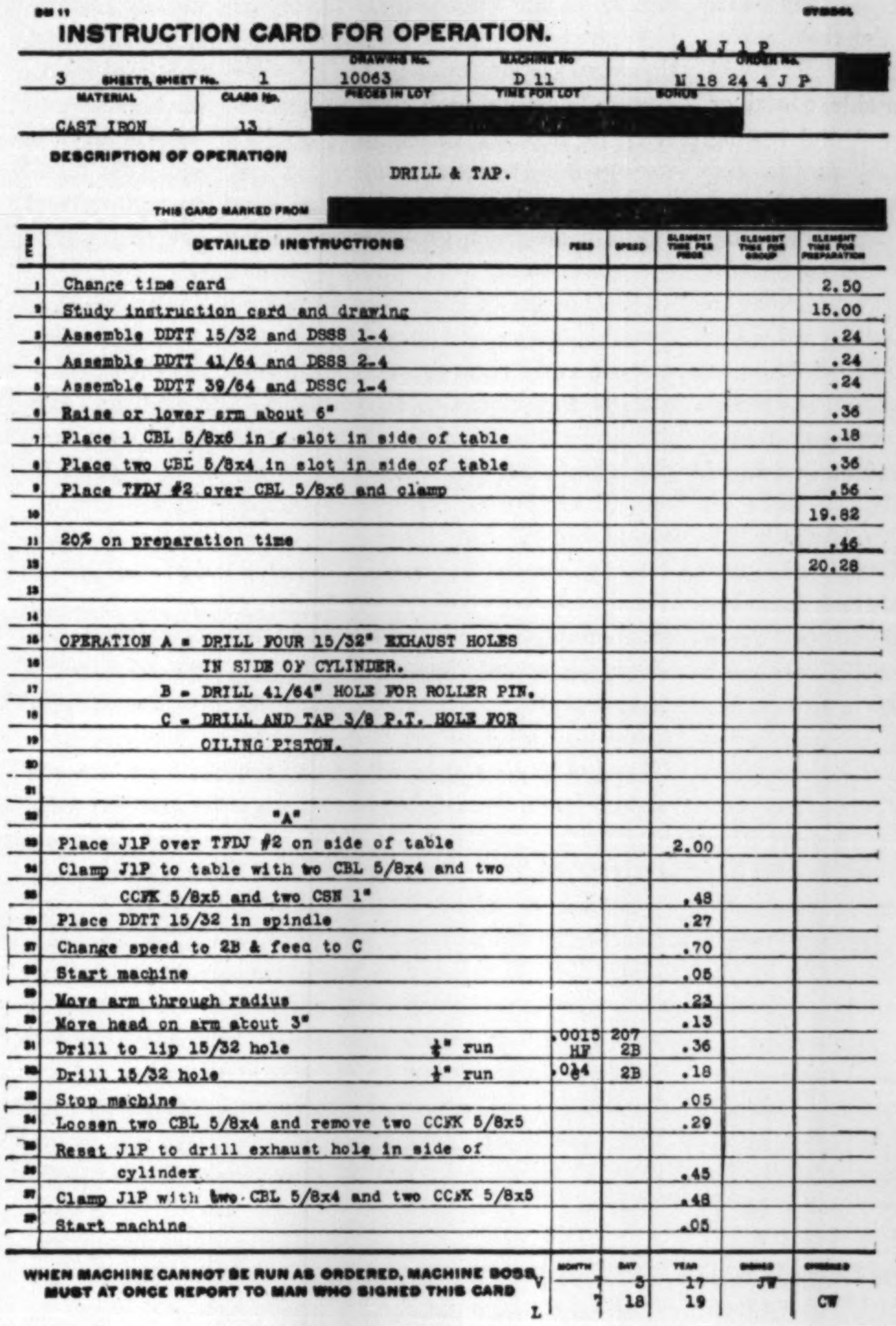


SYMBOL

INSTRUCTION CARD FOR OPERATION.

4 M J 1 P

3 SHEETS, SHEET No. 1	DRAWING No. 10063	MACHINE No. D 11	ORDER No. M 18 24 4 J P	[redacted]

MATERIAL	CLASS No.	PIECES IN LOT	TIME FOR LOT	BONUS
CAST IRON	13	[redacted]	[redacted]	[redacted]

DESCRIPTION OF OPERATION

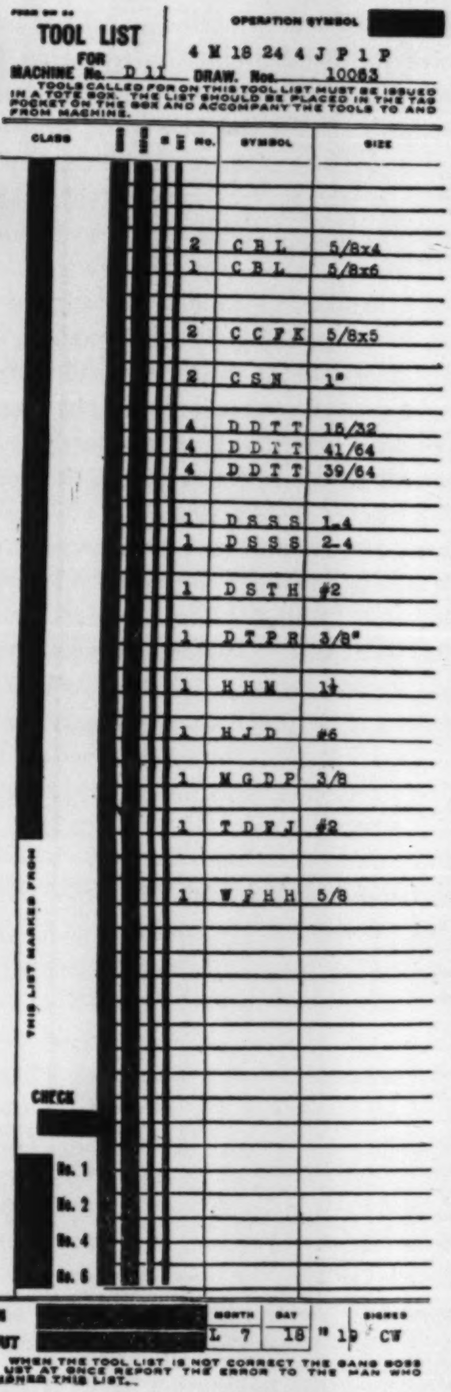
DRILL & TAP.

THIS CARD MARKED FROM [redacted]

ITEM	DETAILED INSTRUCTIONS	FEED	SPEED	ELEMENT TIME PER PIECE	ELEMENT TIME FOR GROUP	ELEMENT TIME FOR PREPARATION
1	Change time card					2.50
2	Study instruction card and drawing					15.00
3	Assemble DDTT 15/32 and DSSS 1-4					.24
4	Assemble DDTT 41/64 and DSSS 2-4					.24
5	Assemble DDTT 39/64 and DSSC 1-4					.24
6	Raise or lower arm about 6"					.36
7	Place 1 CBL 5/8x6 in ~~g~~ slot in side of table					.18
8	Place two CBL 5/8x4 in slot in side of table					.36
9	Place TFDJ #2 over CBL 5/8x6 and clamp					.56
10						19.82
11	20% on preparation time					.46
12						20.28
13						
14						
15	OPERATION A = DRILL FOUR 15/32" EXHAUST HOLES					
16	IN SIDE OF CYLINDER.					
17	B = DRILL 41/64" HOLE FOR ROLLER PIN.					
18	C = DRILL AND TAP 3/8 P.T. HOLE FOR					
19	OILING PISTON.					
20						
21						
22	"A"					
23	Place J1P over TFDJ #2 on side of table			2.00		
24	Clamp J1P to table with two CBL 5/8x4 and two					
25	CCFK 5/8x5 and two CSN 1"			.48		
26	Place DDTT 15/32 in spindle			.27		
27	Change speed to 2B & feed to C			.70		
28	Start machine			.05		
29	Move arm through radius			.23		
30	Move head on arm about 3"			.13		
31	Drill to lip 15/32 hole ¼" run	.0015 HF	207 2B	.36		
32	Drill 15/32 hole ½" run	.014	2B	.18		
33	Stop machine			.05		
34	Loosen two CBL 5/8x4 and remove two CCFK 5/8x5			.29		
35	Reset J1P to drill exhaust hole in side of					
36	cylinder			.45		
37	Clamp J1P with two CBL 5/8x4 and two CCFK 5/8x5			.48		
38	Start machine			.05		

	MONTH	DAY	YEAR	SIGNED	CHECKED
WHEN MACHINE CANNOT BE RUN AS ORDERED, MACHINE BOSS MUST AT ONCE REPORT TO MAN WHO SIGNED THIS CARD V	~~7~~	~~3~~	~~17~~	~~JW~~	
L	7	18	19		CW

FIG. 20. Standard Method Instruction Card.



TOOL LIST
FOR
MACHINE No. D 11

OPERATION SYMBOL [redacted]

4 M 18 24 4 J P 1 P

DRAW. Nos. 10063

TOOLS CALLED FOR ON THIS TOOL LIST MUST BE ISSUED IN A TOTE BOX. THE LIST SHOULD BE PLACED IN THE TAG POCKET ON THE BOX AND ACCOMPANY THE TOOLS TO AND FROM MACHINE.

CLASS	No.	SYMBOL	SIZE
	2	C B L	5/8x4
	1	C B L	5/8x6
	2	C C F K	5/8x5
	2	C S N	1"
	4	D D T T	15/32
	4	D D T T	41/64
	4	D D T T	39/64
	1	D S S S	1-4
	1	D S S S	2-4
	1	D S T H	#2
	1	D T P R	3/8"
	1	H H M	1¼
	1	H J D	#6
	1	M G D P	3/8
	1	T D F J	#2
	1	W F H H	5/8

THIS LIST MARKED FROM

CHECK

No. 1
No. 2
No. 4
No. 6

		MONTH	DAY		SIGNED
IN	[redacted]				
OUT	[redacted]	L 7	18	19 19	CW

WHEN THE TOOL LIST IS NOT CORRECT THE GANG BOSS MUST AT ONCE REPORT THE ERROR TO THE MAN WHO SIGNED THIS LIST.

FIG. 21. Tool List for Instruction Card.

IV STANDARDIZATION OF WORK PLACES AND FACILITIES FOR TRANSPORTING AND STORING MATERIALS

In many industries "hand work" done at benches, tables or work places predominates. The standardization of equipment and conditions is of no less importance than in the case of work in the performance of which machines are employed. Figure 14, taken in the Lebanon, Pa. plant of Herrmann, Aukam & Company, manufacturers of handkerchiefs, is almost self-explanatory. The individual work place for folding handkerchiefs is just the right size, height and slope of the top, permitting the operator to work equally well either sitting or standing and thus to vary the monotony, and there are two standard trucks, one on the left of the operator containing the handkerchiefs flat, in units of convenient size on the board as they come from the ironing machine, and one on the right to receive the handkerchiefs after being folded. I would call your attention to the special open-side container in the truck for finished work, drawn out and resting on a shelf attached to the "work place" at just the right height to receive the folded handkerchiefs and with the hinged end let down so as not to be in the way of the operator's arm. The weight of the units both before and after folding is designed to be such as to be easily handled by the operator and to afford a change from the monotony and fatigue of folding at sufficiently frequent intervals; having folded the handkerchiefs contained on a board and having filled a container, the operator places the container in one of the truck's compartments, puts an empty one in its place on the shelf and takes another unit of flat handkerchiefs from the truck on the left, placing it in position for folding. Regular rest periods are however also provided. The trucks are moved to and from the work place by "move men" in accordance with orders from the Planning Department.[1]

Contrast this condition, the result of exhaustive study and experiment, with what existed before when the equipment consisted of tables, about four feet wide, thirty feet long, the tops about twenty-four inches from the floor, running lengthwise across the factory with an aisle at either end. The operators sat on both sides of these tables, and a person to get through had to pass between the backs of the chairs of the operators. Work was delivered from ironing machines in an ordinary box truck, from which it was taken and stored on any unoccupied table space, in boxes under the tables, on chairs, or in any available floor space. It was "given out" to the operators by the forewoman in batches of from ten dozen to thirty-five dozen at a time—one-fourth to three-fourths of an hour's work; the operator leaving her work place, carrying her finished work to the forewoman's table and getting another job—an awkward arrangement owing to the congestion and to the small jobs given out, partly to equalize injustice or inaccuracy in the piece rates by distributing "good work" and "bad work" to all, and partly because about twenty-five dozen was all a girl could conveniently carry and take care of at her work place. There were usually several girls changing jobs at the same time and consequently there was considerable loss of time and confusion. Naturally under such conditions and with a great variety of product there could be little control of the various lots or orders in progress, materials were damaged owing to poor methods of handling and storing while in progress, production was low and the operators dissatisfied.

As a result of the standardized conditions, of adequate planning and control, and of the establishment of task and bonus the average production on this operation was increased two hundred per cent, and the average earnings of the operators increased one hundred thirty-six per cent. The operator in Figure 15 earned her bonus, completing each job in the time allowed on all but three jobs during eight months. Throughout the department the production reached an average between ninety and ninety-five per cent of that established as the standard of accomplishment. A typical weekly report showed that out of twenty-nine operators thirteen accomplished all of their jobs in the time allowed, six earned bonus on between ninety and ninety-six per cent of their work, four between eighty-three and eighty-six per cent, four between seventy-two and seventy-eight per cent, one sixty-two per cent and one forty-three.

Similar standard work places were designed for each of the operations. Figure 15 shows one for "ribboning," i. e. tying the handkerchiefs on a card in attractive form before boxing. Figure 16 shows a truck station in which "jobs ahead" of the "ribboners" are stored and Figure 17 gives a general view of one department with a truck station in the foreground. The orderly arrangement with its ample and unobstructed aisles is in marked contrast to what existed before.

V STANDARDIZED MATERIALS

Standard materials which may be depended upon to react the same to treatment every time are essential to scientific management. Under the old style management fluctuations in output, due to variations in quality of material, are obscured. Under scientific management they are constantly forcing themselves upon the management's attention and demanding action.

But little in the way of illustration should be needed to show the importance of standardized materials. In the case of winding small coils for electric magnets, related under the heading of standardization of tools, our studies showed that an average of one-fifth of the operator's time was consumed repairing breaks in the wire due to defects. While it had been known to the operators that there was great loss here, it was not realized by the management until the facts were brought out by the time studies.

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[1] The writer desires to give credit for work done previous to his connection with this undertaking to Major Frank B. Gilbreth, particularly in the development of individual "work-places," means for handling ironed handkerchiefs in convenient units, and a standard method of folding. Credit should also be given Major M. C. Herrmann, Mr. Charles Hoffman and Capt. D. J. Walsh for the further development of these methods and means.

Each break necessitated the operator stopping her machine, retrieving the broken end of the wire on the spool, threading it through several guide pulleys, brazing the two ends together and insulating the joint. It was seen that to correct this trouble at its source would require months if not years of work, involving changes in the method of insulating the wire, in the equipment used for insulating and even in securing the cooperation of the manufacturer of the raw materials, by all of which it was ultimately reduced materially. As the number of breaks that might occur during a job could not be predicted, the expedient was adopted of setting the time for the job with no allowance for breaks included. If the time set for a job were to include the repairing of breaks, in order to insure fairness to the operator we should have had to allow time for the *greatest number of breaks that might occur.* This would obviously be too high in the majority of cases. We therefore provided a small printed form for each job on which the operator made a mark each time a break occurred. This slip was turned in by the operator with her time card, and extra time added to each job in accordance with the actual number of breaks.

An interesting commentary on the relations existing between the employees and employers in this plant, and upon the accuracy of the time studies and fairness of the task based thereon, lies in the fact that no evidence was found of any effort on the part of the operators to report more breaks than were actually encountered. Incidentally, I should add that, pending relief from efforts to standardize the wire, the time required to repair breaks was reduced through standardization of tools and machines and improvement of methods.

In machine shop practice the feed, speed and number of cuts are predetermined for each job, and on this basis the cutting time and the time for changing tools is computed. Whether the time set is right or not depends upon the material being standard with respect to hardness and the amount of metal to be removed. If there is any appreciable variation from standard the tool will become dull and have to be replaced before completing the work it should have done; and the speed, feed, or both, will have to be reduced or extra cuts taken, and one or more tools may have to be procured from the tool room. The result is that the job cannot be done in the time set, through no fault of the workman, and extra time must be allowed.

Standards of materials and standards of quality of work done are, after the performance of the first operation, in a sequence almost inseparable. Frequently unless one operation is correctly performed the succeeding ones may not be done in the time allowed or in accordance with the standard method; accurate information as to the quality required, the tolerances or degree of accuracy, the kind of finish, etc. must be supplied in the form of samples, specifications or drawings. Such information is required not only by those who plan the work but also by the operator, the inspector and other functional foremen in the shop. In a machine shop run under the Taylor System not only are detail drawings furnished for each piece and assembled unit, but they contain information, more explicitly and clearly given than is ordinary practice, which by answering all questions in advance, avoids errors or misunderstandings, and saves the time of foremen and workmen seeking information from the draughting room or other sources, etc. The character of this information is shown by Figures 18 and 19.

VI STANDARD PROCESSES OR METHODS

Standard conditions with respect to machinery, tools, other equipment and materials are prerequisite to standard processes or methods, and as a matter of fact, once they have been established in a large measure *standard methods result as a natural consequence.*

There are often several ways of doing a job—but usually only one best way. It is mainly for the purpose of insuring the one best way, making the fullest use of and adherence to the standard conditions established, that work is carefully planned in advance, that route charts and route sheets are prepared, and that detailed instruction cards and tool lists are provided for each operation. In this way we largely overcome the inequalities of experience in various workers who may be called upon at different times to do the same job, and insure that successive operations shall be performed in the most economical sequence. Under the old system of management, John Smith, for example, is an old hand who knows the product and the shop's equipment; he has always done a certain job and has evolved what under the circumstances is the best way —or at least a very good way—of doing it; owing to some circumstance, the next time that the job has to be done John Smith is absent, and it is given to a new man, with the result that he starts in about where John Smith did when he first tackled the job.

In a foundry doing a large variety of work certain large and expensive castings had to be made. It was a rather difficult job, and at first a number of castings were lost while it was being found out how to overcome the difficulties. No record was made, however, of the method developed. Several months later the same job had to be repeated and as both the molder who made it and the foreman had to contend with many other problems in the interval, their recollection of the method arrived at the first time was hazy; the result was that they had to again go over the same ground with its attendant losses.

Standard methods clearly defined by instruction cards based upon the composite best experience of the shop or the industry plus the results of scientific investigation and experiment, not only are a safeguard against such conditions as those cited in the foregoing typical instances, but they serve another equally important end; that of a check against any failure to maintain the standards of equipment, materials or conditions upon which the accomplishment of the job in the standard time, in accordance with the standard methods, is dependent.

In scientific management shops, failure to accomplish a job in the time set indicates in a great majority of cases—except where green operators are concerned—that one or more of the conditions are not up to standard. Sometimes the trouble is so obvious as to make a minute investigation unnecessary; no matter how obscure, however, it may be located with certainty by checking up the operation, element by element, with a stop watch, and comparing the time taken with the time shown on the instruction card. Standard methods are of equal importance in the instruction of new operators whose troubles are often confined to one or two elements of an operation, or due to false moves not easy to detect in the absence of a standard.

Few people realize that the setting of a definite task, or standard of accomplishment based upon a standard method, and the payment of a high reward for its accomplishment, serve a more important end than a mere incentive for the operator. Were we to depend upon incentive alone, the results accomplished under scientific management would never be approached. Straight piece work of the ordinary type would seem to offer all that could be desired in the way of incentive, but repeatedly the production secured under the old style management with ordinary piece work has been doubled and trebled. The development of standards such as I have described and their maintenance does not lie within the power or control of the worker, nor even to any great extent within that of the foreman. The definite task and the high reward for its accomplishment are a power holding the management up to its job—obliging it to maintain standards. In February, 1915, Mr. C. B. Thompson published in the *Quarterly Journal of Economics* the results of an investigation of *"Scientific Management in Practice."* From this I quote as follows:

> If one may judge from rapid personal inspection of employees at work under the system, there can be no question of their closer application and deeper interest in the work they are doing. This interest extends beyond their own work to that of the management. Inasmuch as the success of the worker in earning the bonus depends partly on the smoothness with which the administrative department is conducted, the foremen and other executives receive numerous and forceful suggestions on this score if anything goes wrong. I have often seen workmen reminding their "bosses," in no uncertain terms, of their failure to live up to their managerial responsibilities. In fact, the authority of the operators within their own sphere is one of the outstanding peculiarities of a scientific management plant.

VII STANDARD PRODUCTS

The full benefits of scientific management are never realized until real cooperation between the Planning Department, the Sales Department, the Designing Department and the Accounting and Cost Department has been established.

In machine work standardization may permit the use of commercial articles in place of special parts that otherwise would have to be manufactured in small quantities with universal equipment rather than special equipment. Draughtsmen if left to themselves will often in different parts of a machine use similar parts differing slightly in dimensions where the same size might have been made to serve—or even parts identical with those used in other machines might be used—with the result that such parts could be manufactured for stock in economical quantities and the expense for properly tooling up be justified. Parts may be so designed as to facilitate their manufacture with the equipment available and unnecessary work eliminated. In matters such as these cooperation between the route man and the time study or methods man and the draughtsman is invaluable. It is however in products sold chiefly through the retailers that we find the greatest need for standardization of product and particularly with respect to those of a more or less seasonal nature. In business of this class, encouraged by the buyers of the large distributors—both retailers and jobbers—or by competition, rival manufacturers vie with each other in presenting a wide and novel assortment of styles. In many cases a complete new line is presented each year or season, in others the line consists partly of new styles and partly of the old, and in the worst cases, of all former styles plus a generous assortment of new ones. Some of the styles may meet with large sales, some with less and some may not sell at all. The results of such practice are that between the time of closing out the old line and receipt of orders for the new, work in the factory is slack, much of the plant lies idle and labor turnover is high. Owing to the uncertainty as to which styles will take with the buyers, there is considerable hesitation about manufacturing for stock, not only from fear of being caught with unpopular styles but because by so doing a shortage of raw materials required to fill orders for popular styles might be created. The situation is further complicated by the fact that many large customers demand "special put-ups," special labels, and special boxes which preclude manufacturing for stock.

Conditions such as I have briefly touched upon greatly complicate the problem of manufacture, multiply the work incident to planning and control, and make it almost impossible to keep the employees and the machinery uniformly busy. Fluctuations in the volume of work do not seem to worry the management very much under the old style of management, especially where piece work is in vogue—particularly slack periods. Under scientific management it is quite a different story; workers must be kept supplied with work, and the cost of idle plant capacity is promptly and forcibly brought to the attention of the management as is the inefficiency and high costs of handling small orders and excessive variety.

The manufacturer, or at least the salesman and the designer, may deplore such conditions and regard them as being economically unsound, but he insists that the consumer—usually personified in the distributor's buyer—is responsible: to what extent this may be true is difficult to determine, but if the consumer knew what it costs him I'll wager that he would put up a howl for standardization that could not be mistaken or ignored.

In this direction schools of business administration such as the Harvard Graduate School of Business Administration, the Tuck School at Dartmouth, the School of Commerce and Accounts of the New York University, and no doubt many others with whose work I do not happen to be familiar, have helped, but the most significant thing I have seen is the work of Street and Finney, who call themselves advertisers, but who might perhaps better be called "Engineers of Distribution." They have established a department for the scientific investigation of problems of distribution such as I have touched upon, involving standardization of products, predetermination of the consumers' demand, etc. This work, which was started as an adjunct to their advertising work, ought to and will, I am confident, become of major importance. To the scientific management engineer such a service is an invaluable aid, to say nothing of its value to the manufacturer and the consumer.

VIII STANDARDS AND INCREASED PRODUCTION ESSENTIAL TO BETTERMENT OF INDUSTRIAL RELATIONS

In conclusion let me say that in presenting this paper I do not feel that I am adding anything to the art of management as it was developed by Taylor. My own experience has taught me that the work of Taylor and of those who had the great good fortune to be associated with him through the period of his active and constructive work, as did Mr. Barth, Mr. Gantt and Mr. Merrick, was so fundamental in character and so thoroughly done as to leave little room for improvement; but much is to be done in its extension, in making it understood and in its application to new conditions and in new fields. The country has been flooded with weak imitations of the Taylor System masquerading as improvements under other names. This represents progress—backward.

It is but natural that the members of the Taylor Society should be for progress, that they should desire to live up to its object as stated in its constitution—"to promote the science of management." There are two ways of doing this; by original contribution or improvement on that which exists, and by bringing about a better and more extensive understanding of that which exists and guarding against the loss of that which has been achieved. The former course is perhaps more alluring, but is it not apt to lead us into chasing rainbows or to reinventing, especially if undertaken before the second course has been pursued to a logical conclusion?

In our discussion of the broad questions of economics and of industrial relations, almost to the exclusion during the past few years of the practical problems of production and the technique of management, may we not have been indulging in intellectual joy riding and sidestepping our real task?

I do not wish to detract from the importance of the sciences of economics and sociology, but I do want to point out that "industrial relations" is, like "standards of accomplishment," but a single element in the science of management and largely dependent upon other factors of a more material and unromantic nature.

The happiest of "industrial relations" would be of no avail in the case of a Pennsylvania Railroad without a signal system, without running schedules for its trains, without the track-walkers' daily inspection. The tools ground by the workmen shown in Figure 7 might reflect fine industrial relations but they will not turn out as much product as the standard tool.

Satisfactory "industrial relations," if they are to endure, must have something more solid as a foundation than sentiment or philanthrophy. The most liberal plan for hearing and adjusting "grievances," for collective bargaining, "social service," and even "a voice in the management" carried to the extreme of a business owned and operated by the workers, leaves us still upon the threshold, with the same task before us, that of providing the ways and means. It matters not who selects the managing personnel—provided that they be wisely selected; it matters not who makes the studies leading to the establishment of standards, who makes the route sheets, who writes the instruction cards—providing they be qualified for the work and that it be well done. The important thing to the worker, the employer and the consumer is that these functions *be performed* and that they be recognized as essential to the attainment of the end sought by all.

That scientific management—with its scientifically determined standards replacing "opinion," and placing squarely upon the management and holding it up to responsibilities and duties either previously not realized or evaded, and providing the practical mechanism essential to real cooperation between management and workers—makes for sound industrial relations, removes the causes of suspicion and mutual distrust, and avoids "grievances," has been amply demonstrated.

From all quarters we hear complaints against the high cost of living and demands for increased wages and salaries to meet it. Are the tremendous increases in pay, the shorter hours and other advantages which have been brought about during the past five years to afford us nothing more than subjects for academic discussion, and additional means for conciliation and adjustment of grievances? Are we after all to find the fruit for which we have been striving nothing but empty husks?

Numerous conferences have been held with a view to reconciling the differences and viewpoints of "Labor" and "Capital" and the creation of better "industrial relations"; the press and transactions of our technical societies are full of the subject, and in fact organizations having as their sole object the solution of these problems have been formed. What is back of it all? Merely the insistent demand of society that the old purchasing power of the dollar be reestablished, that it be made worth one hundred cents as of yore instead of the fifty cents as today. In other words the task confronting the nation is the production of two articles where but one was produced before.

Have any of you heard of meetings or conferences being held to discuss the concrete problems of increasing production and to devise definite and practical means for doing so? You have merely heard statements that production must be increased—usually with the inference that it is "up to the workers."

In an address, wonderful for its wisdom and courage, opening the National Industrial Conference called by the President of the United States, Secretary of Labor Wilson again emphasized the need for increased production by the following statement:

> The effect of these things has been reflected in the high cost of living and the consequent demand for higher wage rates to meet the increasing burden of the family budget. Yet increases in the wage rate do not always give relief. There are but two ways by which the general standard of living of the wage-workers can be improved. One is by increased productivity, making more material available for wages. The other is by taking the means of increased compensation out of the profits of the employer. If wages are increased and profits remain the same, the burden is passed on to the consuming public in the form of an increased cost of living, and comes back in that form to the wage-worker himself. No portion of improved living standards can come out of the profits of the employers unless there is profiteering.
>
> And what gives the opportunity for profiteering? The very conditions that we are confronted with today—the destructive agencies of war, the disarrangement of industry and commerce, and the unrest and high nervous tension of our people, resulting in a shortage of supply as compared with demand. The whole world is interested in returning to the highest productive efficiency, having due regard to the health, safety and opportunities for rest, recreation and improvement of those who toil. The more productive we are the sooner we will replace the wastage of war, return to normal price levels, and abolish profiteering. There can be no profiteering where the production is ample to meet the needs of the people of the world if there is a free flow of material from producer to consumer. It is only where the production is not sufficient for the needs of the people, or, when sufficient, where artifical obstructions impede proper distribution, that there is any possibility of profiteering. Anything that restricts the highest efficiency commensurate with the physical, mental and spiritual well-being of the workers tends to retard the progress of the country as a whole.

Apparently, just as Taylor's message in 1895 and in 1903 fell to a great extent upon deaf ears, so was the great importance of Secretary Wilson's remarks lost upon this conference in which such hopes were placed.

Samuel Gompers, in an address before the Associated Advertising Clubs in New Orleans last September, stated an important truth when he said:

> It is said that requests for increases in wages necessitate increases in prices which increases cost of living and in return results in more wage demands—a vicious circle that leads to no progress. It should be remembered that wages constitute only one of the factors in production costs and that high labor invariably leads to labor saving machinery and improved production processes. High wages do not inevitably lead to the vicious circle. On the contrary, they have invariably resulted in constructive changes, beneficial to workers and resulting in increased production. This is vividly brought out by the contrasts in production in low wage countries such as China and production in high wage countries such as ours.

Mr. Gompers is right. Labor saving machinery and improved production processes do and must follow as a result of high labor cost. But who is to provide these means to the increased production, so generally conceeded to be essential to a reduction of the high cost of living? The worker may help—and certainly he will avail himself of them when they are provided—but he is in no position alone to bring about the improvements in conditions, and it is foolish to suppose that in general he can double his production merely by greater willingness, greater diligence or greater energy, as a large part of the general public and many executives and managers would seem to believe.

They can not be brought about by the economist—who may help by predicting their need—or by the social scientist, the student of industrial relations, by boards of conciliation or by conferences between representatives of labor, capital and the public, or by legislation. Even the elimination of profiteering, of extravagance and of strikes will not accomplish all that is desired. There is no short cut—no easy way. It is *work* that is needed, and the job is squarely up to the manager, the engineer and the worker. The increases in production and the consequent increases in pay that I have cited as examples are the results of such work by all three,—worker, engineer, manager; all a part in it, but the major responsibility is now as ever up to the management; it must take the initiative and afford the opportunity for cooperation of the engineer and the worker. If the manager cannot or will not meet this responsibility to take the initiative it seems inevitable that "labor," in order to retain and give substance to what it has gained and under pressure from the public, must assume the task—even though strictly speaking it is not its responsibility.

Taylor believed, preached and practiced the doctrine that instead of waiting for high wages and a consequent high cost of living to force us to eliminate waste, to increase production through the improvement of manufacturing processes and the development of labor saving machinery and devices, that we should by anticipating the need put the horse where he belongs—in front of the cart instead of behind it.

In 1911 he said in the introduction to his book "The Principles of Scientific Management": "As yet there has been no public agitation for 'Greater National Efficiency'; no meetings have been called to consider how this is to be brought about." Remarks such as those of Secretary Wilson indicate that the "agitation" has commenced. It is up to this Society to take the lead in showing how the greater national efficiency is to be brought about. We have waited for the spur of necessity. Now we feel it. "Let's Go."

IX DISCUSSION

Mr. Carl G. Barth[1]: When I heard that Mr. Hathaway was to read a paper on *standardization* I said to myself, "Are we to have that threadbare subject before us again?" for having dealt with it during twenty long years in such a manner that it has become part and parcel of my whole being, I am almost as sick of the word as of the word *efficiency*. For the time being I forgot to think of the evergrowing membership of our Society, consisting as it does to a considerable degree of young and inexperienced aspirants, who have joined for the purpose of receiving instruction and guidance from us elders. In view of this Mr. Hathaway's treatise on the subject is indeed a timely one, besides being exceptionally well presented in several points. A great deal of misconception still exists in regard to what Mr. Taylor meant by standards, and the word has often been used in connections to which Mr. Taylor strongly objected; and he often looked upon such use as a misapplied plagiarism of his own use of the word. Objections have often been raised against the establishment of standards as a procedure that blocks the way for improvements; and under certain conditions, if matters are not properly understood or handled judiciously, legitimate improvements may be too long delayed. In this connection I venture to quote the following from my paper "Standardization of Machine Tools," read December, 1916, before the American Society of Mechanical Engineers.

> Before proceeding to any definite recommendations, it will be well to consider the objection so often raised to the adoption of standards of any kind—that standardization blocks the way for further development and improvement.

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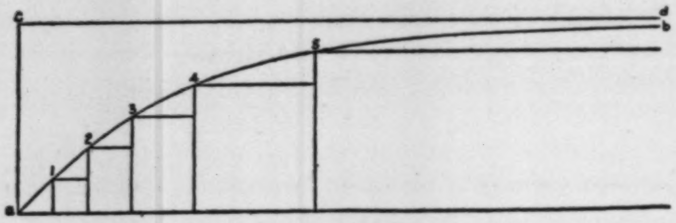
[1] Consulting Engineer, Buffalo, New York.

> If this were unqualifiedly true, standardization would almost be a crime; but if we adopt a standard merely as representative of the best a trade or profession knows of at any one time, with the understanding that as soon as a *decided* improvement is brought out, a new standard will be adopted to parallel temporarily, and eventually replace the former standard, the danger of stagnation will be obviated.
>
> 
>
>
> Fig. 22
>
> Perhaps my idea will be understood more readily by reference to Figure 22, in which the smooth curve *ab* tending towards the asymptote *cd* represents a gradual development with immediate adoption of improvements in any line toward an eventual highest possible attainment; and the broken line whose corners 1, 2, 3, 4 and 5 lie in this curve the only occasional adoption of such improvements, when these have attained enough importance to make it worth while to change from one temporary standard to a new one, both standards then being in use during the period of change.
>
> Such a period will, to be sure, seem exceedingly inconvenient after we have once tasted of the fruits that the use of standards bring forth, but it will be as nothing compared with the troubles and expense of dealing with a lot of unstandardized equipment all the time. "Where ignorance is bliss, 'tis folly to be wise," surely does not hold good in these matters.

I also wish to say a word about the common misconception that a time study is necessary, or a good means, for ferreting out useless or wasteful motions, preliminary to standardizing a complex operation. Such motions are best ferreted out by common sense observation on the part of a person well versed in the trade, who has caught the right spirit, without any time study. The time study properly comes later, and may then be made by a person less expert in the trade; but no amount of mere time study of an unstandardized complex operation will directly lead to the elimination of its useless or wasteful motions. However, such time studies submitted to the scrutiny of a person well versed in the art may be that person's indirect method for detecting and eliminating useless and wasteful motions. Because of the misconception referred to, a lot of worthless time study is being made the country over by mere stop-watch men. Time study should not be taken up until conditions of machines, tools, materials and motions have all been properly studied in an every day, common sense and expert manner, and later standardized on the strength of the information thus gained.

Mr. Charles Wunchel[1]: Colonel Hathaway's paper reminds me of an experience that I had some years ago while working as a machinist, which illustrates the difference between working in a shop where standard conditions have been established and in one run under the old style of management.

The Tabor Company having too much work for their vertical boring mill, and the work being wanted in a rush, tried to find some company that would do some of it for them, but the only thing they could do was to rent a 36" mill in a nearby shop, the Tabor Company to furnish the operator. So I, being an experienced operator, was assigned to do the work. After looking over machine and equipment, the first thing I found lacking were bolts, clamps, blocks, packing pieces, wrenches and tools, so after hunting around the shop and with difficulty getting a few bolts, most of which had threads stripped, and finding it almost impossible to get the other tools required, I went back to Tabor shop and got from the tool room a set of bolts, blocks, packing pieces, wrenches and cutting tools sufficient to complete the job and took them back with me. Well, the next thing was to get the machine in running order. I started to dig the chips from slots of table which had been rusted almost shut; then cleaned table thoroughly; then got ram loose on cross rail after working the best part of one day, to clean and put machine in condition to work. Finally after putting belt on cones and starting machine, setting cut that I thought machine should pull, found out that belt would not pull correct depth of cut, so shut down machine and hunted up belt man. But finally, after a long hunt and much asking, I found him and told him about the belt, and he said "all right I'll be down in a minute;" so I went back to the machine and waited for him. He arrived at last, looked at the belt; took hold and shook it and said; "That belt appears all right;" and before he would take it up and tighten it, I had to start machine to show him that it would not pull. Finally with a lot of grumbling he took belt off and took it away; cut a piece out; relaced it; and brought it back. Finally belt man came back and put belt on machine, and then it was time to go home; so the first day was spent in preparation and cleaning and getting machine in condition to do the job.

The next morning on going into the shop the first thing I did was to oil machine thoroughly, then start cut. My first day's production on this machine was three pieces in 9.9 hours, while in our own shop we were producing eight pieces in the same time. After working in that plant for about a week or ten days I was able to produce five and some days six pieces, but six was the limit due to waiting for help in taking off and putting work on machine. The Tabor Company had secured bids on this work from several concerns, the production promised being from one to three pieces per day.

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[1] Tabor Manufacturing Co., Philadelphia, Pa.

A peculiar thing about the whole affair was the way the men in the shop came around to watch what was going on and looking over my equipment of tools. One man asked me if we had that many tools, bolts, blocks and packing at each machine all the time; he said an equipment like that would not last long around there, as everybody in the place would be borrowing this or that until at last there would be nothing left. I explained to him our system of issuing a complete set of tools for each job. Even the foremen and other officials of the Company would come to the machine and stand and look at me as though what I was doing was something out of the ordinary. Even with a smaller production and using my own tools, the work at this shop was harder for me than at our own shop because the handling facilities were not so good.

I was glad when the job was finished so that I could get back to the Tabor plant again where work was not so hard and conditions were much better. Just before I finished my work the manager came to me and said that if ever I got out of work or needed a job to come over and see him; he would see that there was work for me at their plant.

Mr. W. H. Leffingwell[1]: When we have such an excellent paper as Mr. Hathaway has given, it seems unfortunate that he should have chosen so many of his examples from the machine shop and the factory. I am sure I am not telling Mr. Hathaway anything when I say that these same principles apply to all lines of endeavor, but unless a few specific examples are given in an entirely different field, I fear that the man who thinks "his business is different," will find a loophole thereby to escape. In my experience I have found these principles quite applicable to all phases of office administration, and, as a matter of fact, the common practice of many concerns contains examples of the unconscious application of this same principle of standardization.

Many years ago, the National Cash Register Company standardized certain of their selling methods and it is well known that they have been brought to a very high point of perfection.

The form paragraph system of "dictating" is another well known example of this same principle.

When we are surrounded with so many unconscious applications of this wonderful principle, it seems strange that the average manager does not consciously apply them to every detail of his organization. I think the reason is that the manager is accustomed to considering only the so-called broad aspects of his business, leaving what he thinks are unimportant details to sub-executives with little training in analysis. In one place, the dictating of twenty-four different classes of memoranda was eliminated by multigraphing one standard memorandum with twenty-four suggestive sentences, any one of which could be checked off, thus not only eliminating the dictation but the typewriting as well. It has often been observed that a typist addressing envelopes, unless trained in standard methods, wastes more than fifty per cent of her energy in useless motions. Standardized methods and training will easily double the output.

As an example of how "unimportant details" often cost a lot of money, the following case in the adjustment office of a department store will be given. There were two girls delegated to the task of consulting the delivery sheets when customers claimed goods were not received. Whenever there was a full day's work elsewhere, these girls seemed to be unable to keep up and a third employee was asked for. This did not appear necessary, for the volume of work turned out was not large. When the sub-executive was asked why the work required so much time, he said that he did not know except that this was a position which required a long period of training. I made a personal investigation and found a mysterious chart used by the girls in order to ascertain in which of the sixty odd books (one route to a book) a delivery record was supposed to be. After studying it for a few minutes, I asked the young lady to explain it to me as I could not quite understand the purpose of it.

She replied, "Well, I have only been here about three weeks myself and I don't fully understand it either. The theory is, however, that this is a record of the territory covered by each particular route. Not knowing the city very well, it is necessary for me in many cases to trace out several routes before I find the correct one."

In other words, the chart was prepared exactly opposite to the natural way. It was a simple matter to prepare a directory of all the streets in New York

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[1] President Leffingwell-Ream Co., New York.

City (there are over eight hundred of them), and on this directory indicate the route which covered a particular street or number. Now it is only necessary to consult this directory exactly the same way that one consults a street guide, and the work is so light that the two girls not only handle it easily, but are able to devote considerable time during the day to other work.

This relatively unimportant detail was costing the company over a thousand dollars a year more than it should have cost.

Mr. Henry S. Dennison[1]: I want to express my appreciation of Mr. Hathaway's admirable paper. I desire particularly to do so, because, although I am one of those who have been and shall ever be strongly interested in urging that this Society face the problems which are concerned with the instincts, the desires and the happiness of the worker, nevertheless I agree that it is just as essential to regard the technical problems. They are interdependent; one is no more important than the other. There is no escape from recognizing that. They are equally important because equally essential to the advancement of scientific management. We have a double task; we must study simultaneously both of these problems.

Mr. Daniel M. Bates[2]: You may be interested in the effect of standardization independent of any time study, just as a step towards getting ready for time study, as evidenced by a recent experience of ours. We had a calender running on cotton cloth which was turning out 17,000 to 20,000 yards a day. In getting ready to make time studies to determine exact standards on which to base new rates, and as a result of establishing preliminary, common-sense standards and of getting the workers interested, the production of that calender was increased to a maximum of 54,000 yards per day. We have only recently got to making the time studies and everybody concerned is keen for it.

WHAT too many progressive business executives fail to realize is that the scientific method, or fact analysis, is not to be applied sporadically; is not to be applied here and neglected there; begun and then allowed to lapse. For an executive to appreciate the meaning of fact analysis is not enough. He must create and maintain an organization to apply it. It must become a religion not only to him, but to the others in his industry as well. Simply to order sales to be analyzed, or a new accounting control to be established, without at the same time providing the ways in which it shall be done, and allowing for all of the consequences which will follow, is only to catch a glimpse of the meaning of scientific method. Glimpses alone are not enough; conviction is what is needed, and this must be general and felt by all those on whom responsibilities rest. The lesser officials, the department managers, and even the workers themselves, are the ones who are in a position to see the need for fact analysis; and, if convinced of its services, can be of inestimable service to the management in suggesting improvements to be made and in observing the results of the changes introduced. The technique of scientific method will have to be applied by the expert, but he should have not only the sympathy but also the co-operation of all those in whom any responsibility rests. An esprit de corps is indispensable.

Scientific method has been defined as a state of mind, and this is probably a true characterization if the condition is added, that the point of view it represents is consistent in seeking the truth and being guided by facts not at one time, in one place or under one condition, and ignoring them when it becomes advantageous, or when they are difficult to determine, but in all places, at all times, and under all conditions. Cost accountants, statisticians, and industrial engineers, in the study of business, are continually finding conditions which are deplorable; where every principle of scientific method is violated, and where businesses are running on without cost figures, depreciation reserves, sales analysis, and comparative and basic operating data. A remedy is sought at the hands of the expert, but only for certain specific ills, and not for a complete constitutional treatment. Changes are introduced with fear and hesitancy, doubt characterizing every innovation.

This is not the spirit of scientific method. To the fact analyst, facts are facts. They are welcomed for the truth they contain. The attitude toward them and toward the changes which they make imperative, is positive, receptive, and open minded; not negative, doubtful and hesitant. It is not a little truth, but the whole truth, which is wanted. Nothing is too sacred, too old, nor too customary to be challenged. Truth from whatever source is sought out and welcomed, and applied to problems as they arise. (Secrist, *Statistics in Business,* pp. 39 and 40.)

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[1] Dennison Manufacturing Co., Framingham, Mass.

[2] Agent and General Manager, Lewiston Bleachery and Dye works, Lewiston, Maine.

THE FOREMAN[1]

By

Sanford E. Thompson[2]

WHAT is the foreman's place in modern industrial management, and particularly, during the development of new methods? A foreman often is the chief factor in assuring the success of the work.

This morning we propose to discuss the duties of the foreman, confining ourselves particularly to the foreman in general charge of the room or department —the gang boss, as he is sometimes called—how to fit him for his new duties, how to convince him of the advantages to the company and to himself of the changes in methods, and how to develop him to satisfactorily fill these new duties which devolve upon him.

When I was a young man I was assistant foreman on my first job, and I remember a discussion between the three highest officials of the company on whether a man could possibly make good as foreman if he did not *damn* his men. The conclusion reached was that he could not make a success without a complete sulphurous vocabulary. Those of you who heard Mr. Taylor deliver one of his graphic Harvard lectures appreciate the picturesqueness—at least so it seemed to the listener—of the old-fashioned shop foreman. Mr. Taylor brought out vividly the contrast between the old and the new; he pictured on the one hand the days of the autocratic, domineering task-master whose word is law, whose every action, however unjust, must be upheld by the management, to avoid loss of authority. Some shops still exist that are running on these principles. In contrast he pictured on the other hand the modern way of assisting the workman to do his work properly, instead of damning him for doing it wrong; of showing him the best way to do it; of giving him the right tools to do it with; of giving him perfect materials to work upon; of giving him constant work; of rewarding him in proportion to the quality, as well as the quantity, of his output; of listening to suggestions and complaints with a view to correction and adoption; and finally, of giving him a voice in the management.

Does even this group appreciate the changes in our relation to labor that functionalized foremanship, as worked out by Fred Taylor, has brought about? Do we realize how far this many-pointed contact with the workman is making possible the higher development and closer coordination between the management and the worker that our leaders of thought are preaching?

But to accomplish all of these things, not only must the scheme of organization be changed, not only must the duties of the foreman be revised, but there must be an entire change in the mental attitude of the foreman. It is no easy matter to change from a Czar—for that is his former position—to an instructor, no matter what classic lessons are to be taught in his school.

When a man talks of introducing scientific methods into his shop, I always ask, "How old are your foremen, how old is your superintendent?" I find that after a man is past forty, it is a most difficult thing—although by no means impossible—for him to appreciate that all of the traditions upon which he has built up his prestige must be overturned, that he must see others come in and take away one after another of what he has considered his symbols of authority. He feels until he gets into the spirit of the new methods that he is being stripped of his power, and furthermore that the changes contemplated will disorganize his department.

And remember that a successful foreman of the old school is a man of rather extraordinary ability. Consider the mass of detail he must cover frequently on the spur of the moment. In the daily performance of his duties he must schedule and route the work to the proper machines and operatives; hire the right number and character of operators; adjust wages; settle disputes; inspect quality; insure quantity of production; see that orders are completed on time regardless of the salesmen's eccentricities. Is it any wonder that the average foreman finds it difficult at first to cooperate in new developments which involve radical changes in his manner of life and action?

In the modern plant other men than the departmental foreman plan the work, distribute the men to the machines, indicate the order of the work, designate the amount of work to be done, fix the time of completion of the various jobs, inspect the quality and look after repairs.

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[1] A paper presented at the annual meeting of the Taylor Society, December 6, 1919.

[2] Of the Thompson & Lichtner Co., Boston and New York. I wish to acknowledge my indebtedness to members of our organization for suggestions from their experience. S. E. T.

In connection with scientific development we find the foreman who feels that a thing always has been done in a certain way, hence that way must be right; the foreman who knows it can't be done; the foreman who has tried it out and it wouldn't work; and perhaps worst of all the foreman who says, "I know it can't be done, but go ahead and do it." Sometimes a foreman is reluctant to furnish technical information which he feels is an asset that makes him of greatest value to the company. This is particularly the case with foremen, and there is quite a large percentage who hold their positions in spite of small executive ability because of special knowledge of processes. We find occasionally that a foreman is reluctant to aid beyond a certain point through fear of the discovery that he has turned over to his men certain of the duties which had been assigned to him personally.

After all that can be said in criticism, it is surprising how willing a foreman usually is to cooperate during the period when studies are made preliminary to the actual development of control. One is impressed, however, with his lack of understanding of the results to be obtained. It is always necessary to go into each point in great detail to show where the changes mean real assistance to him in the performance of his duties, and particularly with respect to the competent foreman who always has the good of the company at heart, how these changes will operate to improve conditions.

It is hardest for the foreman after the preliminary studies are complete and actual development is begun and he sees some of his authority passing away. In some cases it seems absolutely impossible to convince him of the advantages until he can actually see results. I have in mind a foreman in a coating mill, a man with a good grasp of his department, but who could not see the advantage of detail study of the methods of handling the rolls, or the way in which the pasting was done, or of counting the defective material; but just as soon as the methods worked out were put into operation and he saw a sudden jump on the first machine in output of over one hundred per cent, and when he saw the operators on the other machines clamoring to be put onto the new plan, it took him just about two days to be converted. But this conversion was later than it should have been. The foreman should be right in on the game from the very start. Those of you, however, who have not been up against it, cannot fully appreciate how difficult a matter it is to manage it. It is much easier to analyze a proposition, develop the scheme, and with complete authority put it into effect, than it is to make the foreman actually a part of the developing force, and have him so considered by the employees and by the management.

Whatever the type of foremen they must be carefully dealt with, and personally instead of in a group. This is particularly true with the cantankerous foreman who tells you that your plan has already been tried and given up; that he put in piece-work once on that particular job and it didn't work; that the variations in the conditions make planning impossible; that he must have first-class quality. He must be shown that as a result of thorough analysis and standardization, both the variation in conditions and the quality are taken care of; that the work will run smoother and the quality will be better than under day work or ordinary piece work.

It is a good plan to get suggestions from the foreman and see that they are put across with the company, and get his approval on everything else that is done; at any rate sit down and go over things with him carefully. Let him see that the increase in output and improvements in conditions will be due to his work and that the credit will not go to outsiders. In case he cannot be convinced, then higher authority must be evoked and the management kept in touch with the actual conditions by frequent reports.

Sometimes the major responsibility for the development may lie with the foreman. In the pulp mills of the Eastern Manufacturing Co., at Bangor, Me., the foreman, who later became superintendent, was the man more than anybody else who put it across. As foreman he was given certain tests to make as of density of the pulp, examination of defects, rate of flow, etc. Later he worked out the standard temperatures and pressures for cooking the pulp in the digesters, interested his men in the development and in the special plans for paying bonuses based on maintenance of standards and on quality of product. In another case the superintendent of the plant, a small one, after the development of the control through the planning department, which relieved him of much of his worry, actually by his own wish became time study man and spent a considerable part of his time on the detail analysis of the operations.

Sometimes the development of the foreman cannot be accomplished. There was a "terrible Swede," a man more than sixty years old, at the head of a department in a textile mill; the department had run down badly, only a small portion of it being in proper mechanical repair. He tried to make all repairs himself, feeling that if he allowed anybody to become acquainted with the machines he would lose his value to the company. He opposed studies in his room, notwithstanding their great need as shown by the poor work produced. Finally an understudy had to be placed there and the foreman demanded a show down, with the result that he had to be pensioned. A young man with no previous experience was placed in charge and he made rapid progress toward intensive and successful control.

Another foreman in the same plant, another Swede in fact, but one of the most capable overseers in the organization, a hard-headed man with ability to maintain excellent discipline and produce good quality of product, was much opposed to the development of new methods; he flatly refused, in fact, to give information to aid the work, and stated that it was "all damn foolishness." He really felt if he gave out information that he would lose his personal value to the company. Much time was spent upon him to show him the benefits to himself, but to no purpose. The work had to be carried on without his cooperation. When the development was about fifty per cent complete, he came to find that he was being relieved of the major part of the burdensome detail which he had been carrying. As the engineer on the job tells the story, Swansen came to him one day and said, "Hanson, I am beginning to like this scientific management." Asked why, he said, "I can go around the room seeing that the weavers are doing their jobs, and I don't have to stay an hour after quitting time at night, all Saturday afternoon and sometimes Sunday, planning out the work. I can go home five minutes past five on week days and five minutes past twelve on Saturday, and not think of the work again until I get to the mill in the morning." One of the most important benefits derived from the foreman's having a definite place in the development of scientific methods is the psychological effect on the employees. He can explain to them the principles being adopted, and enlist their creative powers in applying the methods to the particular work in which they are engaged. Finally, by recognizing the foreman's place we build up a better organization to carry on the work of development after the initial steps have been made, and oftentimes prevent a reaction by the restoration of unimportant details which an unsympathetic foreman might consider as essential.

And don't forget the actual value of the advice given through the foreman's keenness in appreciating the effect on the men and the method of handling them, and his knowledge of processes.

The place for the old foreman in the new organization must be carefully thought out. They are most valuable men. They must be developed for the job they are best fitted for. A foreman has the chance of his lifetime for a position suited to his particular ability. He may, for example, though a mediocre foreman, make an excellent production man. If a good executive, he is naturally left in his old position, but with many of his functions transferred to others. If kept in this place, he must be impressed with the fact that as incentives for quantity and quality are introduced to the operative, his duty must be to guide rather than to command. He must see particularly that the operations decided upon as standard are maintained by the operatives, a thing which is particularly hard to do when they are just starting.

To illustrate, a group of girls were given standard methods of operation with bonus in an operation of pasting which involved considerable manipulation. The work was undertaken with enthusiasm, but gradually, as is usually the case at the start, one of them began to fall off in her production. Investigation showed that she had gone back to the former careless, thoughtless, haphazard methods (this is sometimes called exercising individual initiative) which she had formerly employed, instead of doing the work in the easier way which resulted in her turning out the larger quantity with no added effort. With very brief instructions she came at once to her higher standard and again became satisfied with the work.

The foreman must assist the inspector in designating quality. He must coordinate the work of the operators, movemen, helpers, etc., who are all trying for improvement in the quantity and quality. He is the connecting link between the mill and the office.

Particularly, unless there is a teaching force, he must give instruction of two kinds. He must give preliminary instruction on methods of doing the machine or hand work, emphasizing the necessity of avoiding certain common errors, and he must caution the men at the start on safety in the use of the machine.

Then, second, he must attend to the follow-up instructions. He must be sure that the methods are grasped and understood and carried out.

As an illustration, a man was given a job of punching metal with instructions to punch holes in one end of the sheets. He decided that this was the wrong end, and that they should be punched on the other end, which resulted in the scrapping of a large order. The duration of the operation was long enough so that it should have been caught by the foreman.

The foreman can be of immense aid to the Planning Department, especially in the early stage of the scheduling of the work. He has stored away in the back of his head a lot of very good reasons for running jobs in a certain sequence, and he will open up and give this advice if encouraged to do so. As a matter of fact, one of his principal duties is to consult regularly with the Planning Department with reference to jobs and promised deliveries. The foreman particularly should lead his department in getting out the work and anticipate delays. If a very small shop he may sometimes himself clean up small jobs. He must gain and hold the respect of his men, at the same time turning over the duties of hiring and firing to another department head.

And how about the personal development of the foreman himself? If really competent, not only does he become of greater value to the organization through the experience he gains in the development of the work, and then later through concentration on one instead of on a dozen functions, but he also is in line for quicker and higher promotion through his experience in going to the bottom of things.

I have referred to the pulp mill superintendent at Bangor who assisted so vitally in putting new methods across. The former superintendent was a very smart man; he would make a radical change in method or machinery one week to produce remarkable results, and the next week he would think out and put into force an entirely different wonderful plan. Consequently there was no stability and little real progress. The other man who did the trick was not spectacular. He was at first foreman, then assistant superintendent. In helping and developing scientific methods he showed so much ability that he was made acting superintendent, with the expectation that he would serve under the superintendent of the neighboring mill operated by the company. Instead, however, he developed so rapidly that the plan was reversed and he became the head of both mills. His development was directly due to scientific management. A rise of this kind is by no means unusual.

I have in mind another man, an expert in his line and superintendent of a large plant, who positively would not be convinced for a long time of the advantages of scientific methods. Finally he left the employ of the company temporarily, but later, after the development was quite thoroughly completed he returned to the same position with still larger authority. His changed point of view is illustrated by an extract from a letter which he wrote to a friend about the development.

> We knew nothing whatever about it, but decided that it was worth trying out. We did so, and today it is going marvelously. We were all, including myself, skeptical at the beginning; but I went quietly along and followed matters closely, and where I did not express an opinion one way or the other I watched its development. After having been away during the greater part of last year on account of my health, I returned and found the wheels revolving very rapidly. The system was firmly fixed. It needed some tuning up and I looked over matters carefully and decided that I would talk before the sectional meetings which were held semi-weekly in our service rooms, and through these talks I was able to find out just what each operator and each department was doing, and in any instance, if they were falling down, showing them that we were ready to give them advice. There is a snap and vim to the whole system that keeps everybody working and no soldiering. This you will understand relieves the superintendent and company of a great many worries.

This illustrates the changed attitude that can and always ought to be brought about through the development of the best modern methods of management.

DISCUSSION

MR. BOYD FISHER:[1] At Cleveland recently, I had to address the superintendents and foremen of the twelve plants of the Aluminum Castings Company, and I was assigned the task of making them feel their importance in the company. The preceding speakers had outlined a system of functional management which would take away—first one, and then another, and finally, apparently, all—the duties that the foreman had hitherto exercised. They had been shown that they were no longer little autocrats in business. It then became my duty as personnel man of the company to encourage them by telling them how important they were!

It was not easy to cheer them up, but I was able to tell them one thing at least; that as the result of the inspiration I had got from Mr. Reilly, Mr. Dennison's associate, I had ascertained that our personnel department must in a sense be handed back to the foremen, and that we should stand or fall upon their efficiency in carrying out the ideas and principles of the personnel department.

But, in the light of Mr. Thompson's paper today, I think we might go one step further and say that in the same sense we hand back to the foreman the custody of scientific management. Nor is there any conflict in my mind between the idea of functionalization and the idea of improving the status of the department foreman. The reconciliation of the two ideas has been clearly made by a lieutenant-colonel working in our plants as a laborer. In a little paper on the art of command he has pointed out that one of the most important principles of management is supervision. He said that the most difficult thing in management is adequate, persistent and faithful supervision. It is the thing that takes the most out of a man. It is the thing that requires the utmost exercise of spirit and fortitude. It keeps going the right thing which you have got started; and I believe that this is the primary duty of the foreman—to keep the tryst, so to speak; to maintain the ideals and standards once they are set up. Surely this high duty gives him a deserved place of honor.

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[1] Personnel Manager, Aluminum Castings Co., Detroit, Michigan.

Therefore, if he is to be a partner with you in carrying out the science of management after it is established, he must be a partner with you in the establishment of it; and I think it is a highly important paper that Mr. Thompson has given us.

MR. MORRIS L. COOKE[1]: In a recent discussion with Mr. John Golden, President of the United Textile Workers of America, I asked him what, beside wages and hours, was considered the greatest grievance, or rather what matter commanded the most attention from the two or three hundred thousand men in his organization. He answered without waiting a minute: "The autocracy of the minor officials, including the foremen."

This Society can't do better than go on record as against autocracy anywhere in an industrial establishment, not forgetting the foreman. At the Atlantic City convention of the A. F. of L. this last year, my recollection is that a resolution was presented although not passed, to the effect that after a certain date in 1921 all foremen in union shops were to be elected.

I have seen enough of our political institutions to feel convinced that our boasted freedom does not lie through electing all governmental officials. In the splendid place where I live we elect a town clerk, and we have been electing him for 232 years. His sole duty is to impound stray cattle. We haven't had any stray cattle there for, I believe, fifty or sixty years; but we keep on electing him just the same; we also elect the sheriff, the tax collector and the poor board. But in our political institutions we are getting away from that. We realize that we don't get anywhere by voting on everything.

Can't we engineers, in cooperation with our friends, the owners on one side, and the workers in these enterprises on the other, develop some method by which we can get real foremanship and at the same time not have the domineering type that makes everybody sore?

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[1] Consulting Engineer in Management, Philadelphia, Pa.

MR. H. K. HATHAWAY[1]: I want to call attention to something which you probably all know, and that is, that Mr. Taylor told us that the essence of scientific management lay in four great principles, the second of which was—the scientific selection and training of the workmen following the development of the art.

In thinking of that principle, we may be prone to restrict its application to the workman; but it is undoubtedly equally applicable to the foreman. Recently, the general manager of one of the largest plants in this country in talking with me said: "The thing that I am most anxious for and most interested in, is to find some way to select the right men for foremen and to find a way to properly teach them so that they will truly represent the company in dealing with their men."

I should like to make the suggestion that the appropriate committee of this Society be delegated to set forth what should be done in selecting foremen, and how they should be trained.

THE CHAIRMAN:[2] As there is a little time left, I should like to say a little something about the situation in the shops which I represent. I am going to arrogate that little time to myself, although I believe—at least I have a sneaking idea—that I was appointed Chairman so that I wouldn't discuss these things this morning.

I want merely to call attention to the fact that this is the first paper before the Society relating to foremen. We have given lots of attention to the worker, to the materials and to the management, but the foreman, who is not of the management (and that is a point that isn't touched upon by Mr. Thompson and one of the important points that have been overlooked) has not been given a proportionate share of the attention, either regarding his job, his duties or his training, that other elements in industry have received.

We have found in our shops that one of the greatest obstacles was the lack of attention that management gave to the training of the foremen. That was the greatest obstacle to the practical application of scientific management, involving the industrial relations of the plant, and I wish in this short time to call attention to this one point: that a foreman's job is not a manager's job, and one of the unfortunate things that we

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